THE GLASS INDUSTRY

VOLUME 33, NUMBER 5, MAY, 1952

ORGANIZATION PLANNING IS KEYSTONE OF L-O-F FIBER GLASS OPERATION

BY J. GILBERT MOHR, QUALITY CONTROL MANAGER

Fiber Glass Division, Libbey-Owens-Ford Glass Co., Parkersburg, W. Va.

Although Libbey-Owens-Ford Glass Company previously had some small experience with the formation of glass fibers, it was not until 1951, when this company obtained a license from the Owens-Corning Fiberglas Corporation, that it entered into this new field in earnest.

The earlier venture (1939) was the Modigliani process, purchased from its Italian inventor. It produced a material known as Thermolux in which white or colored spun glass was laminated between sheets of flat glass. The resultant panels were used for decoration, diffusion and insulation. There is an interesting sidelight in the fact that Donald L. McClure, Plant Manager of the new L-O-F Fiber Glass Division, was production superintendent of the Thermolux operation.

Even before this, however, Edward Drummond Libbey, one of the original founders of the Libbey-Owens Sheet Glass Company, early predecessor of Libbey-Owens-Ford, had an interest in fiber glass. He exhibited a dress, lamp shade and other articles made from spun glass at the Columbian Exposition in Chicago in 1893. Besides having this flair for showmanship, it was his dream that manufacture of this type of glass might be profitable.

Immediately prior to company President John D. Biggers' announcement in March, 1951, revealing the company's plans to manufacture fiber glass, a certificate of necessity was issued by the United States Government for the development of this new fiber glass factory to aid in the national defense rearmament program.

It was the company's first entry into an entirely new field since establishment of its Plaskon Division in 1943. Actually it was an historic and important move, since Libbey-Owens-Ford is primarily a producer of polished plate, window glass, laminated safety glass, and allied flat glass products.

The site selected for the new operation was the company's Parkersburg, W. Va., factory, and it was planned that construction would be rushed so that production would be under way in six months from the announcement date.

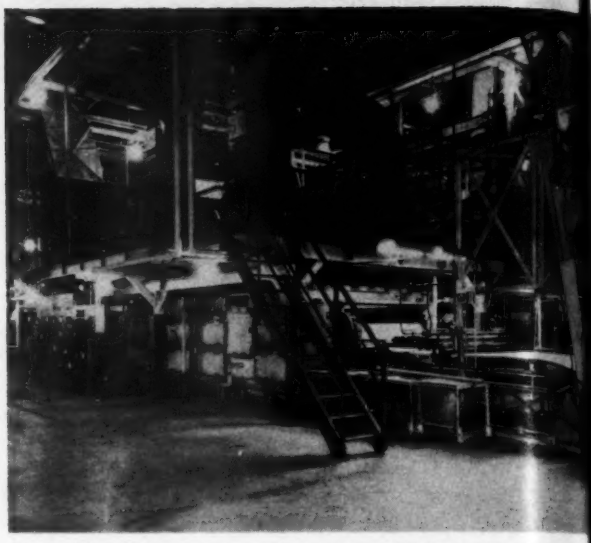
The Parkersburg plant previously housed a portion of the Vitrolite colored-structural glass manufacturing operation. This was centralized at the Rossford, Ohio, plant in May, 1950. The excellence of Parkersburg as an industrial community and its promise of future growth were responsible for the decision to locate the new division in that area. It is in the heart of West Virginia's natural gas, coal and power resources and, in addition, there is an excellent labor potential, highlighted by the previously employed personnel acquainted with company policy and anxious for the company to resume operations. The factory proper occupies 200,000 square feet of floor space and is located on an 18-acre site adjacent to both the Ohio River and the Baltimore & Ohio Railroad.

In order to accomplish the setting up of this new operation after the decision had been made to enter the field of fiber glass manufacture, many seemingly insurmountable obstacles were dealt with and overcome. The complete story is one of an unusual cooperation between management, engineering and technology. This spirit of cooperation in the personnel involved was responsible for the success of getting the plant into early operation.

Since it is the policy of Libbey-Owens-Ford to develop individuals in their respective jobs, giving them a free hand to show inventiveness and initiative, many people were ready to step into positions of greater responsibility when the occasion presented itself. G. P. MacNichol, Jr., Libbey-Owens-Ford Vice President in Charge of Sales, was given top-management responsibility for the Fiber Glass Division. During the time that the decision was being made to enter into this field and in the initial stages of planning and production, Mr. MacNichol was aided by Robert E. Worden, of Worden & Risberg, Philadelphia, management consultants.

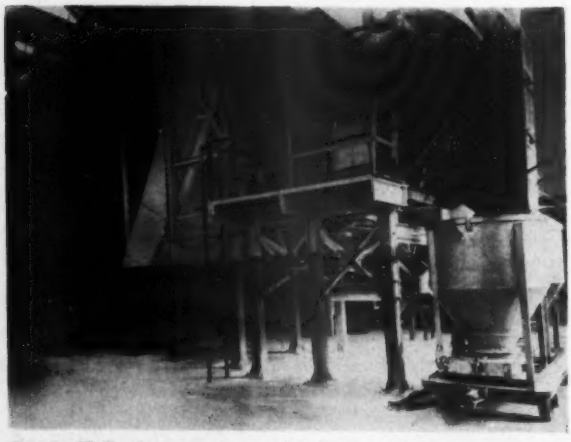
Very recently, J. Melville Johns was named General Manager of the new division under Mr. MacNichol. Mr. Johns has served the company for 30 years in the following capacities: he learned window glass machinery construction at Charleston; supervised construction proj-

Foundation for the Super Fine Department showing preliminary elevated construction for one of the Super Fine machines.



Super Fine Department. Two and one-half months after the picture to the left was taken, this Super Fine machine was completely constructed and in operation. Fiber glass mat is being rolled up at end of machine at extreme right.

View showing the complete Marble Manufacturing Operation. The operation is entirely automatic up to the time the marbles are packaged.



Batch Hall showing the weigh-hopper, hoist, mixer and batch cans.

ects in Belgium and Switzerland; and he was a glass tank shift foreman before entry into sales work. Sales work took him to Minneapolis, Chicago and the far west. After several special assignments, he was made manager of Industrial Sales in December, 1943.

For the appointment of a Sales Manager, Clinton F. Hegg, formerly assistant to the General Manager of Distributor Sales for Libbey-Owens-Ford, was selected. Mr. Hegg is a native of Minneapolis and a graduate of the University of Minnesota in architecture. He joined Libbey-Owens-Ford in 1939 as a sales representative at Dallas. After serving for four years as Lieutenant Colonel in anti-aircraft artillery in the Pacific, he returned to L-O-F in 1945. Immediately, development of a complete sales staff was begun, and regional meetings were held to aquaint the regular L-O-F flat glass sales force with the new fiber glass products.

Claude Harr, previously active in many Libbey-Owens-Ford sales development projects, including formulation of the Solar Orientation Principles, was named Manager of the Sales Technical Service Department. Subsequent sales appointments included Fred Segerstrom, head of Super Fine sales, and D. W. Lyon, head of Textile sales.

At the time the management organization was being formed, project engineers were appointed and transmittal of technological and engineering information from Owens-Corning Fiberglas was begun. Herbert A. Fox, licensee project engineer for Owens-Corning, headed an able group and was liaison between L-O-F and all Owens-Corning personnel, whose full cooperation made organizational and engineering problems much less critical. Mr. Fox has since elected to join the Libbey-Owens-Ford staff as Manager, Technical Department.

Henrik Ring of L-O-F was also appointed a project engineer, and eventually headed a group which supervised ordering and expediting of all necessary materials and re-designed the factory site. In its early stages, the engineering work was largely influenced by the then Director of Engineering, John L. Drake, since deceased.

It is a sad misfortune that he was not able to witness the completion of the project. He has been succeeded by W. H. Hasselbach, present Director of Engineering for L-O-F.

Robert W. Bradley was appointed resident field engineer and moved to Parkersburg. He was later joined by Charles Clark who assisted in expediting construction work, the contract for which had been given to A. Bentley & Sons, of Toledo.

To coordinate groups and interrelate efforts of all concerned, several major committees were formed and monthly meetings were held of a management committee for the purpose of creating a firm policy. Executive and engineering committees were formed and met weekly to deal with the endless details.

A Technical Advisory Committee was created to correlate technological information transmitted and to create purchasing schedules for all expendable materials. D. E. Sharp and Dr. J. D. Ryan, assistant Directors of Research of the L-O-F Technical Department, and Dr. M. H. Bigelow, Research Director of the Plaskon Division, were active on this committee.

As mentioned previously, Mr. McClure was appointed plant manager. He was graduated from Ohio State University in 1930, having majored in chemistry and biological sciences. He has been active in glass operations at the Rossford Plant for 15 years, since joining the company in 1936. His first duties were to appoint supervisory plant personnel and to organize a working force.

Previously associated with the Parkersburg Vitrolite factory management, the following were appointed to staff positions: Homer Wolfe, formerly chief mechanic at the Parkersburg plant, was brought back as chief engineer. He had been working in maintenance engineering at the East Broadway (Toledo) plant for the last two years. Homer Frame, previously Personnel Manager, will have the same duties. Eugene Sinnett was appointed plant Production Superintendent.

In addition, the following were chosen: Charles R. Koehn, formerly active in purchasing and stores at the Charleston, W. Va., factory, was appointed Production Control Manager. J. Gilbert Mohr was moved from the glass technology section, Research Department, Toledo,

Picture taken at time of loading the first carload of Super Fine glass for shipment. Left to right: H. E. Smith, W. Whited, E. A. Eaches (USN), C. R. Koehn, D J. McNutt, K. H. Blakeley (USN), H. D. Frame, W. F. Schneider, E. Moore, J. G. Mohr, E. P. Elzey, D. L. McClure, B. I. Wixey. In the car, E. Brown and J. Tanner.

Fiber glass textile quality control inspector measuring spindle speeds on a twist-frame, using a Stroboscopic Tachometer. The large spools on the upper part of the machine each contain about 90,000 feet of glass strand composed of 204 small filaments. The glass is wound from these spools on to the bobbin used elsewhere in the operation.

Physical testing section of the Quality Control Laboratory. The technician is operating the sink-float apparatus for glass density determination.

Here an operator is carrying out operation of end-finding on tubes of fiber glass textile strands which have just been formed from marbles.

Textile Continuous Forming Department, showing the twist and ply machines and the packing and end-finding departments.

as Quality Control Manager. Robert Bradley, resident field engineer, later joined the factory staff as head of the Industrial Engineering Department. Robert M. Whittington, formerly of the cost analysis department, was appointed Office Manager.

As part of the engineering contract and in addition to engineering services, Owens-Corning agreed to provide on-the-job training for all our supervisory people and also for our factory personnel. Supervisory training was begun at Newark, Ohio, on July 23, 1951 and extended from four to ten weeks. On-the-job training for many shift foremen, operators and other workers was also provided in the Newark and Huntingdon, Pennsylvania, plants of Owens-Corning, and many of their operational people were available to assist the start-up of all operations.

In addition to efforts of all people active in the Fiber Glass Division itself, the whole project moved as fast as it did and was as well coordinated because it got the full cooperation of many men in Libbey-Owens-Ford who were not directly connected, but who served in an advisory or consulting capacity. These include J. C. Diehl and his staff of purchasing agents; James Ashley, who assisted in procuring our Washington connections; the Patent Department; Dr. George B. Watkins and his staff who developed the laboratory facilities; Wilfrid Hibbert, publicity; H. Creston Doner, design; Frank Hawkins, advertising; and D. J. McNutt, office procedure.

The operator in this photograph has just completed making a splice of two ends of fiber glass textile yarn and is allowing the strand to continue winding on the lower bobbins.

In exactly seven and one-half months from the date that the Fiber Glass Division was created, production was started on glass marbles, which is the first step in the manufacture of textile glass fibers. That was on November 4, and on December 1, textile fibers were first drawn from a unit for the production of continuous filament fibers.

On November 16, the first Super Fine unit began turning out flotation material for the U. S. Navy to be processed into life jackets for all armed forces. The complete plant facilities include several Super Fine machines, one large glass melting unit for the production of marbles, one large batch mixing unit, a textile production department which consists of an air-conditioned forming room, large textile winding room, and smaller rooms for special winding operations.

The service operations include a large engineering and maintenance area; loading and unloading facilities; a shipping department which, at present, is no different from other shipping departments in its requirements for more space; a large stores department; and a brand-new, completely equipped laboratory to establish and maintain basic control on raw materials received, plant operations and end products.

Since the manufacturing processes are probably well-known and understood by a majority of readers, it will only be necessary to devote a minimum of space to them here.

In the Super Fine operation, primary fibers less than one millimeter in diameter are drawn vertically from a glass-melting furnace and passed in front of high temperature burners. At this stage they are attenuated to extremely fine diameters between 0.00003 inch and 0.00020 inch, and after any of several types of resinous binders are spray-applied, the fluffy mass of cotton-like glass is gathered on a belt and heat-cured to form the Super Fine mat. Products so formed constitute resilient insulation mat for both heat-excluding and cold-saving applications, water repellent material for life jackets and clothing inter-liner, and in the finest fiber diameter, superior thermal and acoustical insulation of the lightweight variety necessary for aircraft.

In the textile operation, marbles are fed into small high temperature melting units of unique construction, and filaments slightly larger than the coarsest Super Fine fibers are drawn from these units on a high-speed winding machine. Again, a sizing treatment is applied to augment desired properties of the glass. Subsequently, the textile strands are rewound as twisted and plied yarns on a multiple variety of packages and shipped to weavers of cloth or electrical manufacturers. This type of fiber may also be used either as woven cloth, roving, or chopped fibers for reinforcing plastics where highest possible wet-strength retention and high strength-weight ratio of the completed plastic article are desired.

(*Continued on page* 272)

MAINTENANCE IN GLASS PLANTS

BY W. F. HEFNER, PLANT ENGINEER

Pittsburgh Plate Glass Company, Creighton, Pa.

In order to provide a better conception of our maintenance problem, it may be well to give you a brief outline of the maintenance organization. My remarks will deal with our experience at Works No. 1 of the Pittsburgh Plate Glass Company, Creighton, Pennsylvania, which is primarily a plate glass plant.

The maintenance organization consists of approximately 325 men, of which approximately 55% are mechanics and helpers, 25% electricians, 10% machinists and 10% pipe-fitters. This group comes under the direct supervision of a Master Mechanic and Chief Electrician, who, together with their foremen, handle the maintenance of the plant from the receipt of the raw material to the finished product. This organization also takes care of equipment replacement or changes, installs machinery, repairs and maintains all buildings and equipment throughout the plant.

Inspection and Maintenance Procedure

We have maintenance men assigned around the clock in the production departments. These men take care of the repair, inspection and lubrication of the machinery and equipment. They make written reports covering the work which they have performed on their shift; also any defects or defaults in equipment which may require special attention. These reports are delivered to the Master Mechanic or Chief Electrician, as the case may be, and any conditions which may require special attention are referred to the foreman in charge of maintenance in this operation, who takes steps to have the conditions, as reported, checked and the necessary repairs made.

There is also a small group of men who work on shifts around the clock, but are not assigned to any department. They make inspections and repairs in departments which have no assigned men, help out in case of a major breakdown and carry on with work that has been listed for their attention.

The glass-melting and rolling departments operate on a 24-hour per day, seven days per week basis. Motors and equipment, which cannot be shut down while operating, are installed in duplicate. This permits the shut-down of one unit at a time for repair without interfering with production. At various intervals these operations are shut down for short periods and all repairs must be planned and made during these shut-down periods.

The grinding and polishing operations are shut down eight hours each week for the inspection and repair of machinery and equipment. The repair jobs for each week are carefully listed, needed material is made ready, and, as far as is possible, delivered to the job. The necessary men are scheduled and assigned to each job in order to complete the work in the allotted time. Occasionally, longer shut-down periods may be scheduled to take care of work that cannot be completed during the regular weekly shut-down periods.

At regular intervals the grinder and polisher trunks and tables are removed from service for adjustment or repairs. A complete record is made of the condition of the table or trunk, repairs made and material used. These records, for each trunk or table, are filed in the Master Mechanic's office for future reference.

Motors and Electrical Equipment

We have approximately 2,500 motors, both A. C. and D. C., from fractional H. P. up to 300 H. P. Some of these motors are inspected weekly, others more frequently, depending upon the conditions under which they operate. Motors, which must operate for a full week or longer and would cause production loss if shut down, are given a detailed inspection each time the operation permits.

Motors are usually cleaned and minor repairs are made on the job, but in case of a major repair, they are removed and sent to the repair shop for a complete over-all repair and test.

Control Equipment

The control equipment, used for starting and controlling motor operations, is checked visually while the motor is operating, and in detail at various intervals when the motor is shut down.

In the plate glass operation there is a large quantity of control apparatus, such as starters, limit switches, relays, solenoid valves and push-button stations, which is part of an interlocked automatic operation of various equipment. This control apparatus must be inspected and kept in a good state of repair at all times. Spare parts are available at all times, for the failure of any one piece of apparatus may shut or slow down production.

The Electrical Department maintains a complete card record of all motors, their location, equipment numbers and all pertinent name-plate data, such as type, model, frame number, speed, voltage, order number, date purchased and whether A. C. or D. C. The Mechanical Department maintains a card record on all machinery and equipment, showing location, name-plate data, equipment number and purchase order number and date.

All spare parts for the electrical and mechanical equipment are carried in the Stores Department. All parts are cataloged showing the bin number and the equipment on which they are to be used.

Preventive maintenance is an important factor in reducing maintenance costs, since it makes it possible for maintenance departments to plan and schedule the work for regular shut-down periods. It also helps, materially, in reducing unscheduled shut-down periods and loss of production, due to the failure of machinery or equipment.

Electrical Power and Distribution

The power for plant operation is brought into the main sub-station at 25,000 volts and is reduced to 575 volts, which is the normal operating voltage.

All high-voltage transformers and switching equipment are checked each year, bushings are cleaned and the oil is tested. If the oil breaks down below the required voltage, it is filtered. (*Continued on page* 271)

Presented before the Plant Maintenance Conference, Philadelphia, Pa.

Entrance to the exhibition of the Frederick Carder display. A curtained doorway framing a wall of ultra-marine blue on which is a large photographic portrait of Mr. Carder.

Pieces shown include paintings of the Corning countryside, recent bronzes, the Crucifixion in carved glass, with the Virgin Mary and Mary Magdalene in relief on the base, and bronze heads of Mr. Carder's grandsons.

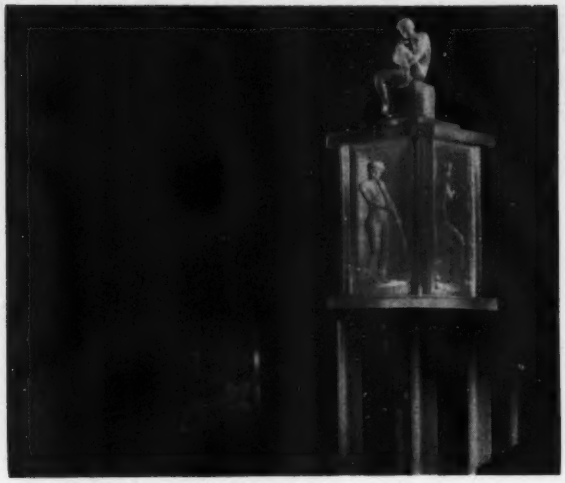
THE WORK OF FREDERICK C. CARDER

An exhibition of the life work of Frederick C. Carder is on display at the Corning Museum of Glass at Corning Glass Center. Mr. Carder, internationally known artist, designer and glassmaker, works in the medium of glass, bronze, marble, wax and oil paint. The exhibit was arranged by Thomas S. Buecher, Museum Director.

The exhibition, which is actually a visual biography of Mr. Carder from his birth in 1864 to the present time, is divided into three general categories: Mr. Carder's English work produced during his student days at Stourbridge Art School and as a designer with the glass firm of Stevens and Williams; his work produced as Manager of the Steuben Glass Works from 1903 to 1918; his work for Corning Glass Works from 1918 to 1934, including the paintings and sculpture in glass executed during his retirement.

Of the glass pieces on display, sections are devoted to heavy crystal pieces, architectural glass, and etched Cameo, rock crystal and opal glass. Aside from actual pieces of his work, the exhibit also presents sidelights in Mr. Carder's life. Sections of the exhibit are devoted to photographs of his early childhood, his marriage, his move to the United States and his civic activities.

The above case contains modern cut pieces made in imitation of natural crystalline minerals. The frieze on the right is an architectural motif in sculptured glass representing mounted spearsmen.



This corner of the exhibit includes a 1950 piece, "Rubinof and His Violin," The Thinker, a Monument to the Glass Industry, honoring the glass blower, furnace tender, finished product and designer.

English paintings and sculpture. Upper right: Unfinished carved cameo plate on amber matrix. Wax on glass models for cameo vases: Cupid & Psyche and The Muses.

Mr. Carder's family and community life. Small bronzes of Mr. Carder's sons. Plaque, "They died as they wished to die," from the Corning Public Library.

Table set with Rosaline and Reeded glass illuminated by an Aurene chandelier. Aurene lamp of acid etched cameo supported by bronze figurines.

FIVE GLASS CONFERENCE PAPERS SUMMARIZED

Application of Time Study to the Glass Industry

By Carl R. Yeater, Standards Manager,
Fostoria Glass Company, Moundsville, W. Va.

With incentive payments, both the company and the employees benefit. The individual benefits by greater monetary reward for time worked, which is a result of his own direct increase in efficiency, and the company benefits by a larger output from its capital outlay and a lower cost per unit. Incentive payments depend upon time studies and merit ratings as the yardstick of measurement of work or value.

Time study in its most elementary form consists of the observing, the recording, the rating and the analyzing of the elements that make a job. While it is an easy matter to observe an employee at his work place and list the various functions of his job, it is a step in time study where quite a few failures occur due to the assumption of the observer that certain information is not necessary even though it is a definite part of the operation. In other words, insufficient information is taken.

The most important part of a time study is the speed rating. This speed rating is actually the judgment by the time study men of the speed or efficiency of the operator in performing his job as recorded on the time study form in rating the operator above or below a normal performance.

Most jobs consist of make-ready, do and disassemble, but some jobs may have necessary idle time, attention time or some abnormal condition that does not occur in other jobs. This must all be taken into consideration in the final analysis, along with personal needs and rest time. From this information, a final standard or allowance is set up for performance of the job. Once standards are established, they must be controlled and maintained. This means that it is necessary to observe periodically all jobs to see that the methods have not been changed from those used at the time of study.

At Fostoria, prior to time study, the employees were paid under two types of incentive, one group being paid under the Book Move System, while the other group was paid under a quality bonus system. These two types of incentive payment worked against each other, one produced as much as possible, while the other threw away as much as possible. Needing extra production and knowing that 90% of the Book Moves were unfavorable to the employee, it was decided to see how time study principles would apply to the Pressed Factory.

As each item was made in the factory, time studies were taken on each operator in the shop. This information was accumulated with consideration for working conditions, molds or any abnormal condition that might arise. Fix-up in preparation at the start of a turn and tearing down at the end of a turn were also studied. From these studies it was found that in most cases the presser was the bottleneck, i.e., the operator in the group having the most work to do.

The normal time needed by the presser on each shop to produce an item was added 12% to 18% fatigue to provide for rest and personal needs. This normal time including fatigue allowance, was converted to standard hours/100 pieces. This expression of standard hours/100 pieces means the time required by the bottleneck operator, working at a normal rate of speed, to produce 100 pieces of ware.

Up to this point, no provision had been made in the value for ware lost due to bad glass or bad work either in the factory or in the selection from the lehr. Proper allowances were made as follows: Counters were installed on each press to record the number of pieces made in the factory, and this number of pieces made at the press compared to the number of pieces sent into the lehr represented the % of ware discarded in the factory at the shop. Accurate records on the pieces good as compared to the pieces sent in to the lehr on each item were available. From this information, the normal time, fatigue, and normal factory and selection loss allowances could be incorporated in the standard value.

In the original installations, normal bad glass % was included in each standard. After the bonus was applied and in practice, it was decided that allowance should be made for a bad glass. In paying for bad glass, it was necessary to take the original allowance for this item out of the standard, thus reducing it. At the same time, the fix-up credit and mold charge allowance was changed from an individual standard for each piece. At present, in establishing a final standard, the following formula is used: normal seconds per piece from time study plus fatigue allowance divided by 3600 seconds/hr. $\times$ 100 to convert standard to hrs./100 pieces. To this is added actual factory loss and selection loss. This results in an accurate time allowance/100 pieces. Then is added 13½% or 18% (the breakover point between large and small items) to compensate for fix-up and tearing down on each turn and an average amount of mold changes. This result is the final standard. From this final standard, premium money is paid to every employee on the shop based on the number of pieces of good ware, seconds and bad glass.

Since the adoption of this incentive plan, production per shop employee has increased and unit costs reduced. Other benefits are as follows: less dissatisfaction now due to transferring an employee from one shop to another as there are approximately the same earning possibilities on each job in the factory; better morale prevails due to increased take-home money; the company has a more accurate method of determining the true overhead and burden costs which results in a more accurate selling figure.

Examples of how time study was applied to mold cleaning and the printing operation in the Etching Department were also described.

The other incentive plan involves merit rating. Merit rating may be defined as a semi-scientific method for evaluating the worker who performs a job—a system for discovering and classifying the individual differences among employees. Merit rating determines to what extent the worker is deserving of premium pay—the extra

These papers were presented in full before the Twelfth Conference on Glass Problems, University of Illinois, Urbana, Illinois.

amount awarded in addition to the base rate for accomplishment above the level corresponding to a minimum acceptable performance. It reveals the differences in individual capacities and the value to the employer of each worker thereby determining the pay differential to which each is entitled.

For example, in the case of the maintenance crew, the following seven factors are necessary for the proper evaluation of the individual:

(1) Quantity of Work—This factor has to do with the degree of quickness in getting the work done. It appraises the effort applied by the worker.

(2) Quality of Work—This factor has to do with orderliness in working methods, care of equipment, handling of materials, neatness of products and the extent to which the employee's production is free from errors.

(3) Attendance and Punctuality—This factor is the actual clock time taken from the employee's card and has to do with the number of times and duration of employee's absences.

(4) Cooperativeness—This factor is a group classification and includes such behavior traits as teamwork attitude, conduct, loyalty and the ability to lead others in the group.

(5) Dependability—This factor assesses the trustworthiness of the employee and his inclination and ability to do the assigned work in the manner shown.

(6) Initiative—This factor refers to the employee's tendency to avoid idleness and to work effectively without direction or urging.

(7) Versatility—This factor gauges the ease with which the worker learns new tasks and takes into account the number of different tasks that he can satisfactorily accomplish without further training.

All of these factors are not of equal importance. Each factor is assigned a "weight" or "value" according to its relative worth in regard to the type of work being performed by the employees to be rated.

To insure fair comparative and accurate appraisals, all the foremen and assistants up to the level of Plant Engineer do the rating. At the rating time, the Standards Supervisor will sit with each rater and score out each person on each of the seven factors, comparing each employee in the group to the whole group. This is done every three months, the scoring being based on the employee's activity the previous three months, but the result to apply to the future three months. After these results are analyzed and compiled, the results of the "scoring" form are converted to a % wage chart, ranging from a minimum of 0% to 24% maximum premium. The classification that an employee gets determines the % of bonus he is to receive. This % is posted in the department so that each operator knows the classification of all other employees. Also, an individual card showing the scoring under each factor is issued to the foreman for each employee and he is to discuss the reasons for the scoring of each factor to that employee.

A Resumé of Problems in Hand Plants and Suggested Areas of Improvement

By C. J. Uhrmann and A. C. Ottoson,
Imperial Glass Corporation, Bellaire, Ohio.

From the standpoint of crystal glass quality (freedom from objectionable color), the total amount of iron oxide in the finished glass must be considered because only a portion of it originates with the various raw materials, while refractories in contact with the glass contribute at least an equal amount. In addition, other sources, such as cullet and working tools, can be a major contributing source.

In general, the total amount of iron oxide in the finished glass should not exceed 0.02%. If this degree of purity can be maintained, only very small decolorizer additions are needed to produce crystal glass of superior quality. If the iron oxide in a crystal glass totals near or above 0.05%, then large doses of decolorizers are needed which result in dark, lifeless glass, regardless of composition.

To reach the desirable low iron content, it is necessary to select all raw materials from a standpoint of objectionable iron contamination. Many individual plants have done this and it is suggested that if the whole hand glass industry would follow and contribute to this effort, it is believed that further improvements would result. Even after raw materials of the lowest possible iron content are obtained, it is equally important to minimize all possible contamination during unloading, storing and handling during the weighing and mixing within the plant.

Routine checking for uniformity of chemical analysis was recommended for, with raw material uniformity, juggling of decolorizer charges from day to day can be eliminated and the glass quality from a color standpoint will level off and can be held to a minimum of variation.

The various refractories available to hand plants are a constant source of iron contamination, as well as the most frequent cause of cords and stones. In recent years the actual cost of good quality glass from pots, calculated on the yield per individual melt, has risen to an all-time high in most plants. On the other hand, the cost of glass from tanks has been lowered because of extensive developments and greater improvements in tank blocks. The need for better pots and other secondary refractories at this time appears to be greater than ever before.

The recent development of cast pots indicate an early improvement in quality. As the casting of refractories usually results in denser clay bodies, more careful and prolonged arching appears to be necessary. Extreme caution is necessary during the water soaking period due to the difficulty of removing the pore water and hygroscopic water from the denser body. This means that improved pot arches will be needed. It would be desirable to prolong the arching of the pots to a point where all shrinkage has been removed and no further changes can take place in the furnace. This should result in uniform wear of the pot surfaces during melting and not only increase useful pot life, but also assure better glass yield.

In tank melting, the products of combustion can change the color of crystal glass to such an extent that decolorizing becomes ineffective. Careful control is therefore essential. Tank melting of most soda-lime glasses requires an oxidizing atmosphere to produce a good crystal and while this type of combustion is seldom conducive of lowest cost and largest tonnage output, the end result, colorwise, justified the added cost and decreased output.

Draft control, fuel-air-ratio control and flame control are recommended as steps towards combustion control. In the case of flame control, burner nozzle pressures, proper sizes and design of burner nozzles and rigidly

held nozzle positions are necessary to achieve control of character, direction and length of flame. Flame impingement on the surface of the glass during and even after the melting is complete can easily cause serious color changes in tanks and influence melting time of individual pots in a pot furnace.

While the principal factors in a glass composition for hand production usually are easy melting and good workability, with durability being of secondary importance, it is believed that an extensive study of small additions of various special glassmaking materials, which are used without actually knowing why, would reveal valuable information. Careful investigation of changes in viscosity, surface tension, liquidus temperature, solution capacity for various refractories solution of gases and other functions resulting from addition of various materials would produce invaluable help to hand plant operators. Since many of these investigations should be finally carried out in fuel size pots or tanks under hand production conditions in various plants, it would be necessary to support such a program by a large group of plants and over a long period of time to assure practical and usable information.

More attention should be given the mixing room in hand plants. Dusting should be eliminated but excessive dust exhausting be guarded against as it itself can cause troubles through the removal of essential parts of the batch. Dust losses during mixing can be minimized by the careful and controlled use of water. Magnetic separators are a must. Cullet crushing to a desired state is now the practice so as to insure the most practical size which causes the least amount of ware of the crusher and, therefore, the lowest iron contamination of the cullet.

Charging of Batch and Flow of Glass in Continuous Furnaces

By A. K. Lyle, Hartford Empire Company, Division of Emhart Manufacturing Company, Hartford, Conn.

The successful operation of a continuous glass melting furnace depends upon the temperature distribution within the bath of glass and upon the distribution of the batch, or partly melted glass, over the surface of the melting end. These two distributions are inter-dependent and together control the path through the furnace that will be taken by a given small portion of glass from the time it enters the furnace as raw batch until it leaves as finished glass.

There are other factors which are critical in furnace operation, such as the temperature, the rate at which batch is introduced and the type of glass melted, but all of these are determined by energy requirements and are not dependent upon a cycle or process. In this discussion it will be assumed that the glass is sufficiently easy to melt and to fine and that the fuel input is sufficient to melt the required amount of glass.

In small pot or crucible melting, the pot and contents are subjected to high temperature until the resulting glass is a more or less homogeneous liquid. The temperature is then decreased to the level desired for working and the job is complete. If the melting unit is a large pot or a day tank, the procedure becomes a little more complicated. Instead of simply applying heat until the job is finished, it is usually necessary to employ some special techniques to obtain satisfactory homogeneity. The addition of batch in several steps or the continuous addition of batch at a rate that permits it to melt continuously may be necessary to satisfactory homogeneity. For special uses, the glass may be stirred mechanically.

The process of continuous melting consists of adding batch to a furnace and having all of that batch turned into satisfactory glass as it passes through the furnace to the working end. The process cannot be greatly different in fundamentals from that of producing glass in a crucible or day tank, but one difference does exist. In a crucible or day tank, the whole body of glass passes in successive steps through the melting and fining and cooling stages. In a continuous furnace, all stages of glass production exist simultaneously and with no readily apparent dividing boundaries. At the rear of the furnace, the glass bath contains batch and partially melted glass. Toward the middle, the batch may be completely gone and the glass filled with bubbles. Near the front, the glass is completely melted and fined but not too hot for use. Finally, in the working end, the glass is cooled for use. That all of these conditions of glass can exist within a single structure without too much intermingling is surprising. That occasionally partly fined glass and particles of batch do find their way into the finished glass is to be expected.

The partial or blended separation of the various steps in the production of glass is brought about by the flow of the glass in the furnace. This flow is established by differences in density that exist within the body of the glass. The differences in density have several sources: (1) differences in temperature, (2) the presence of gas bubbles; (3) bulk density of the batch materials and (4) differences in density among the several batch materials.

The glass forming process is primarily one of melting rather than solution due to the fact that the layer of batch receives most of its heat from the top. In the direct melting of the glass batch, there is a strong tendency for the easily fusible materials to melt and run away from the materials that are more difficult to melt, with the result that silica or high-silica glass is left as a floating residue on the surface of the glass. Unless an excessive amount of time is taken to completely dissolve the residue, it usually accumulates and finally, under the worst conditions, practically stops the melting operation.

Comparison of the two methods of distributing batch in the melting furnace shows that the addition of piles of batch is to be preferred. The lump additions result in uniform melting. The addition of a layer of batch results in uneven melting and consequent cordy glass.

In operation of continuous furnaces, the batch is commonly introduced at a doghouse, or charging bay, located at one end of the structure. It is pushed into the furnace proper by manual or automatic means. Instead of placing the batch over the normal hot spot of the furnace, it is placed away from it so that natural flow of the glass is toward one side of the batch rather than all sides. The charging of the batch to a continuous furnace presents the possibility of (1) intermittent charging and (2) continuous charging. Either of these procedures can employ (a) pushing of the batch in combination with hot glass so as to oppose natural convection and (b) pushing of the batch only so as not to interfere with the convection currents.

If the batch is placed in the doghouse and then floated as a raft into the melting area of the furnace, local convection is set up toward the raft of batch and homogeneous melting and solution take place. In this type of charging, there is very little motion of the batch relative to the glass immediately surrounding it. In hand operation by this method, more effort and more skill are required than by other methods, but the results are usually very satisfactory.

In the second variation of intermittent charging, batch placed on the surface of glass in the doghouse is simply spread over the surface of the melting end by pushing the batch into the furnace without disturbing the glass in the doghouse. In this type of charging, the convection currents tend to leach the batch of its most easily soluble or fusible materials and to leave a layer of high-silica glass or, for worst conditions, a layer of silica scum.

For automatic charging of batch, continuous screws, reciprocating pushers and a variety of mechanical means may be used. Nearly any type of mechanical stoker can be made to operate satisfactorily under some conditions and even the best designed chargers can be improperly operated to produce a poor result.

One automatic charging method projects a continuous stream of batch into the furnace. This method, however, has two drawbacks: (1) the stream may extend too far down the furnace for melting and fining to be complete before the glass leaves the melting zone; (2) the stream has a tendency to go down one side or the other of the furnace where the heat is not as intense as toward the middle of the furnace. Both of these result in inefficient use of the melting surface and some limitation on the amount of glass that can be melted. These drawbacks can be overcome in several ways: by introducing several narrow streams from locations along the rear wall of the furnace, by introducing a wide stream which blankets a large portion of the melting surface, the alternate charging of two streams that cross in their paths so that at intervals the streams are broken by mechanical timing devices, or by the provision of a charging mechanism designed to change the direction of a single stream.

Much has been said about the mixing action of convection currents, it being generally supposed that proper convection is essential to thorough mixing and, therefore, some attention must be paid to the distribution of heat in the furnace. Actually, the convection currents within a tank are relatively slow and certainly are not very powerful. Furthermore, convection takes the path of least resistance and does not possess the characteristics of mixing which involve shear, acceleration and turbulence. The only force in convection currents that is available to do work is the difference in level of glass between the hot spot and the surrounding edges of the furnace. Calculations show that the power available is almost negligible. This does not mean that convection currents are useless, but only that temperature distribution within the furnace is of minor importance compared to the mixing action effected by melting batch. Flow of glass toward the melting batch supplies heat energy to the process while the continued flow downward and away from the batch provides effective mixing by intermingling of the old with the newly formed glass.

The best opportunity for mechanical mixing of melting glass and batch occurs in the process of charging the batch. Conventionally designed doghouses provide isolation of a small part of the tank portion of a furnace from the extreme heat and at the same time provide an almost infinite supply of hot glass. These conditions suggest the possibility of mixing or blending the batch with the already formed glass so as to minimize the possible differences between the two and to prevent segregation of constituents. An enfolding type batch charger has been developed to accomplish this and is recommended for use in side-doghouse furnaces because of its ability to direct the batch across the furnace.

Development of Supervisors

By Harold Mayfield, Asst. Director of Industrial Relations, Owens-Illinois Glass Company, Toledo, Ohio.

Almost every supervisor was once a workman—and a good workman or he wouldn't have become a supervisor. As such, he worked with *things*, tools, machines and materials. When he became a supervisor, he was expected to get results, not through the work of his hands alone, but through the efforts of the people he directed. Now he was working with *people*. The skills that determined his success as a workman were of little help to him now. He began to learn through experience that management is a distinct skill in itself.

A great majority of good supervisors get results almost wholly by intuitive methods. Our experience throughout the whole development of human knowledge has indicated that intuition is just a preliminary step in the development of real understanding. It follows that the greatest results will occur when we lift human relations out of the field of intuition into the realm of understanding. Studies have shown that the best supervisor gets his people to make a large share of the decisions so that the people become creative and responsible individuals rather than just hands. Also that the best supervisor relieves the fears, anxieties and other tensions.

Improving the abilities of supervisors is not an easy task. It is difficult because it requires a change in attitudes—long-established habits, views and personality—attitudes that have been developed over a lifetime. It is not easy to change attitudes. Even in those instances where a man reached them by logical processes, he clings to them with tenacity and emotion. We recognize this by saying that attitudes are seldom changed by argument. Argument usually generates force of opposition and results in a strengthening of previous opinion. If it is so difficult to change other people's attitudes, we are forced to conclude that our greatest hope lies in creating an atmosphere in which constructive change can take place in the learner's own mind. The newer approach to education requires the active participation of the individual who is learning and one excellent method of getting participation is by discussion.

Summing up: (1) each supervisor must be helped to master certain management skills which are entirely separate from his technical knowledge of the work; (2) the supervisor gets his results primarily through people and he gets his best results when his attention centers primarily on the people themselves, rather than upon the job to be done; (3) the supervisor develops most rapidly when he participates actively in the learning process, expressing his ideas freely and growing through his own experience.

Batching Plants

By J. L. Klug,

The John L. Klug Corporation, Rochester, New York.

As a result of its experience in the design and construction of silo plants for the storage and distribution without segregation of anthracite coal, the author's company became interested in the batching problems of the glass industry. After several years of investigation into existing glass industry batch plants and after several bin installations designed to prevent segregation, the Klug Corporation was given its first opportunity to design and build a complete batch plant. The story of this installation and new installations is given below.

It was impossible to incorporate all of the theories we had developed in the preceding two years, as it was necessary to co-ordinate the design of the new plant with existing raw materials and batch storage facilities, and certain existing equipment. Fortunately the available ground space was very limited, and no objection was offered by our client when we proposed a silo thirty-one feet inside diameter, extending thirteen feet below, and one-hundred and ten feet above the grade. We had previously discussed such a design with a number of people in the glass industry, only to be told that the silo would be too high and was impractical. Actually, our theory was the same as employed for years in grain elevator construction, and bulk storage facilities for other materials.

The basic principle is to elevate and concentrate the storage section of the structure to gain the following advantages: (1) conservation of ground area and structural economy, as the per ton cost of confined bulk material storage is usually less in a narrow and high bin than in a larger and lower one; (2) with smaller bin areas, dead storage loss in the bottom of the bins is greatly reduced; (3) mechanical distributing requirements at the top of the plant are also reduced or possibly eliminated by use of gravity chutes; (4) mechanical reclamation from the bins may be eliminated and gravity chutes substituted; (5) the stored materials can be weighed progressively from gravity chutes into a single scale hopper by manual control. If automatic or semi-automatic weighing is required, it involves only one small vibratory feeder for each material and still only one scale. The progressive weighing with one scale is as fast as the mixing operation, so that no time is lost in a complete mixing cycle. With widely spread storage bins, either a portable weighing device to reach all of the bins, or a belt conveyor operation with a scale at each bin is necessary for manual weighing control, and both are slow operations. For automatic weighing under the same conditions, one or more belt conveyors are required as well as two feeders and one scale for each material. That is an extremely expensive arrangement. The materials are weighed simultaneously, and the actual weighing cycle is usually faster than necessary; (6) gravity transfer of the materials is obtained from scale hopper to mixer, from mixer to a surge hopper and thence to an elevator or conveyor, if the batch is handled mechanically; (7) the compact arrangement is extremely economical as to operating and maintenance costs, and initial equipment expense.

Our design was accepted and the plant was completed early in 1945. As far as we know, it was the first of its type, and radically different from any previous batch plant design. The main silo walls were of tile, and the upper section of the silo was divided by tile partitions into ten compartments with a total capacity of eleven-hundred and sixty tons of raw materials and cullet. Batch was elevated to existing belt conveyors and stored in existing bins back of the furnaces. Cullet was crushed in the basement and elevated to the storage section. The general operation of the plant was satisfactory, and we later built another of similar pattern for the same company.

In all, we have designed and built nine complete glass batch plants, and also furnished the complete design and all equipment for four more, in which case the building construction was by others. Five of the total were built for one company and two, including the first plant, for another. In eight of the plants we exercised a theory that had been foremost in our mind since construction of the first individual batch bin. That theory was the practicability of storing mixed batch right in the mixing plant. The per ton cost of batch stored in that manner was structurally and mechanically far less than in an individual bin isolated from the batch plant, or in containers. Operating costs were reduced to a minimum as one elevator received as many as three kinds of batch from the mixer and placed them in their proper bins. Sufficient storage capacity was provided to permit single shift mixing and as insurance against production loss in the event of mechanical failure in the processing equipment. That hazard was greatly reduced because the only processing equipment necessarily involved for manual weighing control was a single scale, the mixer and the elevator. To gain automatic or semi-automatic weight control, only one small vibratory feeder had to be added for each material.

In the later designs, a small vibratory feeder was introduced to control the flow of batch from the surge hopper below the mixer to the batch elevator. In all but one or two of the earliest designs, batch distribution at the top of the plant was done with chutes without mechanical equipment. If two or more different types of batch were stored, diversion was accomplished by a device we developed and designated as a transfer box. The original design of the transfer box has been much improved. They are now leak-proof under any circumstance, and may be power-operated and interlocked. They will divert as many as four materials from an elevator or conveyor to different points, and we use them for raw materials as well as batch.

When storage requirements necessitated the use of more than one bin for a single type of batch in order to maintain a reasonable limit in bin area, deflecting devices were developed and placed in the chutes to insure that the batch entered only one bin at a time. The bins were thereby filled in a certain rotation. In one case, where three bins with individual capacities of sixty tons held batch for one furnace, other devices were installed in the withdrawal chutes to empty the bins in the order in which they were filled and this was done without electrical or manual controls of any kind. The mixing cycle in the plants in which the batch is stored is very fast. Three batches are constantly in process: one being weighed, one being mixed and one being elevated. In most cases, even with manual weight control, the dis-

(*Continued on page* 268)

EARLY GLASSMAKING IN CALIFORNIA

BY J. STANLEY BROTHERS, JR.

The Pacific Glass Works

The first glass made west of the Rockies was manufactured in San Francisco by the Pacific Glass Works, and the first article, a bottle, was blown on June 16, 1863.

Incorporated in October 1862 with a capital stock of $50,000 (increased later to $100,000, with $70,000 paid in on assessments), the original officers included Giles H. Gray, President, Charles Kohler, Vice President, and John Archibald, Secretary. John Taylor, of 514 Washington Street, an importer and dealer in druggist's and chemist's glassware, was the first company agent.

This five-pot pioneer plant was erected at the Potrero, at the corner of Iowa and Mariposa Streets, on ten acres of land purchased by the incorporated company, and began operation with about 25 or 30 experienced eastern operatives, plus an equal number of local men and boys. They ran about eight or nine months out of each year manufacturing green, black and blue glass in any desired shade of color, in the form of wine, liquor and mineral bottles, bottles for pickles, mustard and other condiments, acids and patent medicines, fruit jars, pressed telegraph insulators and other similar types of commercial pressed glass.

Local sources provided most of the glassmaking ingredients, with sand coming from the San Francisco hills, and manganese, from Red Rock, in San Francisco Bay. Salt cake, produced as refuse from nitrate of soda by a local chemical works, was of a quality sufficient for colored glass, but soda ash was imported from England. Pots were made on the premises of English clay.

A lack of eastern competition, occasioned by the exorbitant cost of freight, and the resultant loss through breakage which occurred in transportation, assured the success of the infant industry. This status was also secured by the newly-imposed tariff on wines imported in bottles, and the rapid development of a wine-growing interest in the state of California.

The original incorporators did not long continue to operate the undertaking, which, from gathered reports, was turning out about $6,000 worth of glass a month, and in 1866 the works were being run by Messrs. Saulsbury, Kirk & Mordecai, under lease from the company. This workman-combination soon became inactive, however, due to their inability to agree upon how to handle matters of business, and in 1867 the plant was leased to Bennett & Co.

Meanwhile, John Taylor had entered partnership with James H. Paige, forming John Taylor & Company at the original address on Washington Street, and though Taylor had previously relinquished his connection with the works, the firm once more became agents for the Pacific Glass Works, acting in behalf of the new proprietors, Bennett & Company.

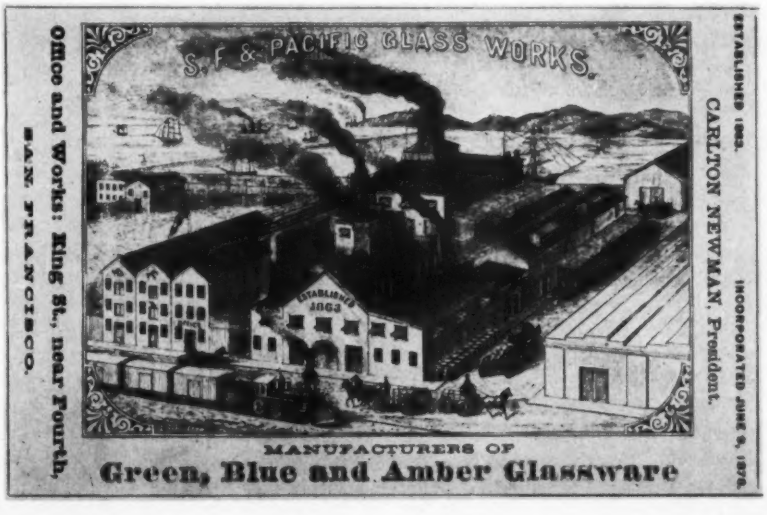
Bennett & Company, comprised James C. Bennett, C. Bennett and Isaac T. Mordecai, and these men immediately increased the capacity of the plant with the construction of a new seven-pot furnace, confining their output to colored glass and producing about $2,000 worth of acceptable goods each week.

Apparently this arrangement continued without interruption, until 1870, when James C. Bennett and John Taylor became the proprietors. The association lasted until the death of Bennett in 1875, when Taylor survived him.

Taylor retired from the business in 1876, when the factory lost its singular identity, and was purchased outright by its competitor, the San Francisco Glass Works. The name lived on, however, in the consolidated title, the San Francisco & Pacific Glass Works, but the old plant was dismantled, and its activity extinguished. Thus were the curtains closed upon the performance of an American enterprise which was the first to have produced its particular wares in the Golden West.

The San Francisco Flint Glass Works

This plant came into existence in 1865 as a direct competitor of the Pacific Glass Works. The proprietors, Carlton J. Newman, a former Pittsburghite, and Patrick T. Brannan, located their 8-pot frame factory on the south side of Townsend Street, near Third, but between Third and Fourth, in an area known as South Beach, not far from the Bay. Operation began with a force of about



Wood-block cut by Emil Schultze, San Francisco wood engraver, showing the San Francisco & Pacific Glass Works as the concern appeared in the Fall of 1881.

40 men and boys manufacturing flint glass in the form of druggist's and chemist's ware, tubes, chimneys, lamps, etc., while also making wine and soda-water bottles, demijohns, carboys, and other items in green and black glass. This combination was made possible through the invention of a melting pot in which Newman had successfully produced both clear flint and the cheaper types of colored ware. Sand for the former came from the beach beds in Monterey county, while the colored goods were made from sand secured in the vicinity of Oakland, across the Bay.

In July, 1868, the works were practically destroyed by fire. Glass was being produced at the time, having an approximate value of $1,800 a week, and while the firm was in possession of a back-log of orders sufficient to keep the establishment in operation for more than four months, Newman & Brannan, nevertheless, dissolved partnership.

San Francisco Glass Works

Early in the following year Newman was again making glass at the old stand. He had recruited limited means, and had set about making black and green hollow ware in the reconditioned furnace. John Winter was his agent. He continued this status until 1870 when he formed a proprietorship with Charles J. Duval, under the style of Newman & Duval. In that year $20,000 was spent in building an adjacent factory near the foot of Fourth Street, between Townsend and King, and a downtown office was opened at 313 Davis Street. A factory office was also maintained at the foot of Fourth.

As the need for glass kept constantly rising, the Pacific Coast became a fertile field in which to manufacture all kinds of common articles, and Newman & Duval helped to satisfy this demand with their production of green and black glass in the form of carboys and demijohns, bottles for wine, medicine, soda-water, pickles, spices and others too numerous to mention. They gave particular attention to private mold work, making molds for all kinds of lettered bottles, and furnishing these molds to their clients at from ten to thirty dollars apiece.

By 1873 management had again reverted to Newman, and his agent was Justinian Caire, a hardware and crockery merchant. In the interim he and his competitor had a combined payroll of more than 110, and the two firms were producing glass valued in excess of $200,000 a year. Three years later C. Newman & Co. was formed to take over the factory and to considerably expand it by the purchase of the competitive Pacific Glass Works.

The San Francisco and Pacific Glass Works

This consolidation took place on June 9, 1876 when a stock company having a capitalization of $100,000 was formed, and articles of incorporation were executed which combined the assets and good will of the Pacific Glass Works with those of the San Francisco Glass Works. This displaced the firm previously operating as C. Newman & Co. and put Carlton Newman at the head of the combination as President and General Manager. The acquired plant was dismantled, and its activity forever extinguished, but the San Francisco factory remained at its operating location, and the new company embarked upon the manufacture of green, blue and amber glassware, making all kinds of plain and lettered bottles as one of their chief specialties. They manufactured "C. Newman's Improved Elastic Demijohn," for which Newman had been granted a patent in January, 1875, importing the cane for its wicker-like covering from China. They also produced another specialty—the Groove-Ring (self-sealing) Fruit Jar, invented by Robert Arthur, of Philadelphia, in 1854, one of the most successful and popular jars of its time, and they continued to make the 1858 Mason jar which John L. Mason had invented in 1856 and had first patented in November 1858.

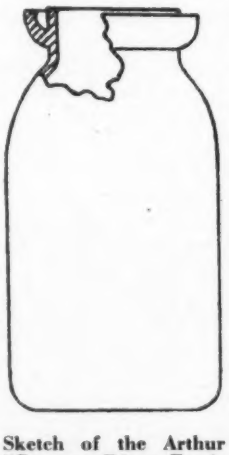
It is not known what effect the depression of 1878 produced on the activity of the concern, but in May of the following year the company was doing a large business in fruit jars, and in 1880 business was flourishing. An advance in materials at this time forced them to raise the price of their goods by about 10%, but this did not prevent them from enjoying continued prosperity. They were shipping their products not only to Oregon, the adjacent territories and to British America, but also to Mexico, the Islands of the South Sea and to Australia.

During the Fall of 1880 Newman made one of his periodic trips to his native Pittsburgh to study conditions pertaining to the advancement of the industry, and to engage workmen for the operation of a new furnace which the company was building on Berry Street at the rear of the factory on King, and which went into operation for the manufacture of bottles and similar glass on June 24 of the following year.

This productive expansion gave the company two green glass furnaces which were turning out fourteen tons of metal a day. It necessitated the employment of about 200 hands, and created a product worth in excess of $250,000 a year.

The works now covered a lot 200 x 225 feet, which was crowded with buildings. Realizing the futility of further local expansion, the company purchased land at the corner of 7th and Townsend Streets, where, in the Fall of 1883, they erected a factory for the production of flint glass, installing an eight-pot, gas-fired Siemen-Martin furnace having a diameter of fourteen feet and capable of producing four tons of glass a day.

During the previous September, Newman had made another trip east to recruit labor and had secured the services of a superintendent who understood factory erection and, as well, the manufacture of druggist's ware, lamp fonts, chimneys, fish globes, jelly glasses, tumblers, confectioner's jars and other specialties which the company was ready to make in January of 1884.



Sketch of the Arthur "Groove-Ring Fruit Jar," invented in 1854, with portion of ring broken away to show construction.

1886 proved a turbulent year for the production of fruit jars in California. The company had been making and supplying at satisfactory prices the jobbers of the Pacific coast with Mason and Gem jars under licenses from the Hero Fruit Jar Company, of Philadelphia. They discontinued this practice at the close of the fire in 1885, and when activity was resumed they

Remains of the West Berkeley Works as photographed by the author in August 1947. The cracks which were caused by the Earthquake of 1906 are visible in the chimney.

were producing jars of different origin. Dismayed at this, the eastern company shipped, via water, a vast quantity of jars to San Francisco, landing them in time for the Spring trade at prices much below the usual jobber's rate for this ware. Prices promptly plummeted for the various sizes, from $13.50 to $9; $15 to $9.75; and from $18.50 to $13.25 a case. The California company sat tight, letting the storm blow by, but they did not make any money on jars. Then, after it was all over, they decided to do something about it.

They purchased additional ground at 7th and Townsend Streets and by November of 1886 they had one of the most up-to-date glass plants of 8-ton capacity ready for production. They concentrated all subsequent activity at the new location, and dismantled the outmoded furnaces and equipment on King Street. Thus did the factory continue to prosper under the foresight and direction of Carlton Newman.

Death, due to heart failure, came to Mr. Newman unexpectedly at his residence in San Francisco, on March 8, 1889. He was born in Wheeling, Virginia, in 1829, and learned glass-blowing at an early age, migrating with his mother and brothers to Pittsburgh in 1848. While at Pittsburgh, he perfected his knowledge of the trade, and he moved to the Pacific Coast in 1862.

The company continued and was operating under the same name and at the same location, at the close of the 19th century, making Druggists' and Liquor Dealers' green and amber glassware, along with the other specialties for which it had become so well-known. It had managed to outlive each and every early competitor, and to prosper even under some of the most discouraging of circumstances.

The California Glass Works

The short-lived California Glass Works, which began with William D. Loos as President and Lewis W. Frisbie as Secretary, was incorporated with a $50,000 capitalization in 1881. Located at the southeast corner of Utah and Alameda Streets, the factory was projected to blow all kinds of glassware, bottles and glass vessels of every description. The directors of the company included William D. Loos, Lewis W. Frisbie, Alonzo T. Ayers, Frank W. Gough and Benjamin C. Craffam. Mr. Ayers was placed in charge of production, and Mr. Gough, an expert glassblower, superintended shop activities. The works had only been in operation a short time, however, when they ran into difficulties which forced them to be sold out by the Sheriff of the town in April of 1882.

In a subsequent reorganization, Maurice C. Blake, of Blake & Blake, attorneys at law, became President, while William B. Lake, acted as Secretary and General Manager. Frederick W. Lake was placed in charge of the books at the company's office at 405 Front. Factory operatives included such well-known glassblowers as Patrick Kennedy, Jeremiah Healey, John Lillihan and William Kane, and pots were made on the premises of Jacob Hoff.

Operations were resumed in the Fall, and the company advertised that they were again prepared to fill orders for green and amber glass. But subsequent problems, encountered from operating in competition with the San Francisco & Pacific Glass Works, made the road too difficult to travel, and, even though they now possessed the means by which they might have put up a formidable fight, they decided to discontinue operations in the Spring of 1883. They sold their stock and available glassmaking materials to their rival, and thus were the books closed upon another incident of glassmaking in the early west.

The Oakland Glass Works

The following year, on the opposite side of the Bay, another unsuccessful venture in glass took place at Oakland. This was the projection of the Oakland Glass Works, located on the marsh land near the foot of Market Street, which, in 1884, was put into operation for the production of bottles, flasks, demijohns and fruit jars. The latter was possessed of a new device for closing the top, and was to have been one of the firm's major specialties. William B. Lake, who had been connected in a similar capacity with the previously defunct California Glass works, was manager of the Oakland enterprise, while Wm. F. Perry, a commission merchant in San Francisco, acted as agent for the firm with an office located at 214 California.

The company owned an 100-acre bed of the finest silica located at Carmel Bay, Monterey County, and used this clean white sand for their glass. They imported their coal from Sydney, Australia, but all of their other materials were of local origin.

It is entirely probable that some of the machinery from the ill-fated California Works was used to equip the Oakland plant, and it opened under what seemed to be the most favorable of circumstances. Bad management, however, in the face of stiff competition doomed it to defeat in less than a year of operation. The company became

financially involved, was sued by its creditors in Superior Court, and in July 1885 suffered the placement of an attachment upon its entire premises. From this they were unable to recover. They had in transit at the time, a carload of pots and a carload of clay which they were unable to receive, and these were liquidated by the Southern Pacific R.R. sometime in September.

The Campbell Glass Mfg. Company

This firm originated as the Campbell Glass Works, being a partnership between John Campbell, of San Francisco, and J. H. Flickinger, of San Jose, California, under the name of J. Campbell & Company. A flint glass factory, costing $55,000 with its equipment, was erected during the Winter of 1884-5 near the depot at West Berkeley, under the experienced direction of W. O. Davis, of Pittsburgh. The works had barely made glass when Flickinger and Campbell dissolved partnership by mutual agreement. Not wishing to carry on the business alone, Mr. Campbell incorporated under the title of the Campbell Glass Mfg. Company, and gave some of the blowers a chance to become affiliated on a cooperative basis. The capital stock was set at $125,000, and this was divided into 500 shares, each valued at $250.

Production constituted druggist's glassware, and included prescription bottles as well as bottles for wine and beer. A trade-marked specialty, the "Wheeler" fruit jar, used accumulated scrap, and the company had on hand at the time of reorganization enough material to produce approximately 700 tons of glass.

For reasons perhaps known only to Mr. Campbell, Mr. Davis was discharged when the reorganization took place, and the destiny of the works was placed in the hands of an unidentified manager. Davis instituted legal proceedings to recover from J. Campbell & Company the sum of $21,800 as damages and for services rendered the defendants.

The factory fires were extinguished on the 11th of July when it was found that the plant could not be run successfully under the adverse conditions which confronted the management.

Further disposition of the plant's operation could not be learned, but it is definitely known that the West Berkeley premises were afterwards used to make glass, as may be adjudged in part from the following brief reference to a later activity.

The Holt Glass Works

William Holt operated the West Berkeley location from approximately 1892 to 1896. In August of the latter year, however, the Holt Glass Works was advertised to be sold out by the usual procedure of a Sheriff's sale, and so it is to be presumed that some sort of a disruption of plant activity took place at that time.

The works were in operation at the time of the San Francisco earthquake which occurred on the morning of April 18, 1906, but it was never subsequently used, due to its structure having been then rendered unsafe for the further production of glass.

Miscellaneous Early California Activity

John Mallon & Company operated the first glass cutting establishment in California. The firm began in 1858, at 14 Beale Street, near Market, in San Francisco, and did all kinds of cutting on imported blanks. With him was associated Thomas O'Neil, who a short time later established his own glass cutting and staining firm and successfully operated it until 1880, when he was succeeded by James McCarthy, one of O'Neil's own workmen who carried on the O'Neil tradition for many years at the latter's original location, No. 10 Stevenson Street. McCarthy, in turn, had started back in the mid-Sixties as a member of the firm of McDermott, Graham & McCarthy.

Mr. Mallon being an energetic man was also engaged in the business of staining and manufacturing ornamental flat glass at 303 Mission. The firm originated in the late Sixties under the style of Mallon & Boyle, but William Boyle did not long stay in the business, and by 1873 John Mallon was operating both the cutting and stained glass establishments. About 1880 his son, Peter L. Mallon, stepped into the managership of the latter organization, and together they operated both locations. The Mallon Art Glass Works made stained glass for many years at 1211-15 Howard, while John Mallon & Company continued to cut glass in its diversified forms at 19 Fremont. In 1893 the Mallon interest became known as the Pacific American Decorative Company, with offices at 26 O'Farrell and factories at 28-30 Eighth, and 19 Fremont. This arrangement continued until heart failure suddenly took John Mallon in December, 1897. Before the turn of the century Ingerson & Glaser had become successors to the Mallon stained glass business at 26 O'Farrell, and the cutting activity had been absorbed by John A. Lynch, under the style of the Pioneer Glass Works, operating from the original location at 19 Fremont. Mr. Lynch had long been associated with Mallon, having worked at the cutting trade with him for over twenty years.

Thus did John Mallon exert a profound influence upon the art glass activity of the early west. He was the inventor of the process of taking photographs on glass and burning them in, and introduced a number of novelties to enhance the spectacular possibilities of the business he followed.

Mallon's contemporaries grew in proportion as the years rolled on. His earliest, perhaps, was his own protege, Thomas O'Neil, of whom mention has already been made. Robert Mills, a fancy glass stainer and cutter, was in business at 303 Mission as early as 1867. Mallon bought his establishment in 1869, and Mills was with Mallon until he again established himself at 118 Main in the early Seventies. He continued in business at several subsequent locations for many years, operating his own Ornamental Lamp Factory in San Francisco until he was absorbed by Emil Boesch in 1885. Boesch was a patentee and manufacturer of various types of patent lamps, reflectors, etc., which were of importance in their own field, but which were not of special interest to the glass trade.

Wilhelm Holst, assisted by Oscar Holst, entered the local picture as an artist decorator of glass at 45½ Fremont in the mid-Seventies, and moved into 118 Main when the location was vacated by Mills. He moved subsequently to 145 Valencia in the mid-Eighties, and to 134-139 Guerrero in the early Nineties, and the firm was operating at that location, doing cutting, embossing, stained glass work and fine enameling, when the new century put in its appearance.

Samuel E. Hopper was another man who belonged to the early glass cutting and staining fraternity. His first

(*Continued on page* 268)

Inventions and Inventors

Furnaces

Batch Feeder. Fig. 1. Patent No. 2,585,607. Filed June 25, 1941. Issued Feb. 12, 1952. Three sheets of drawings. Assigned to Westinghouse Electric Corporation by J. B. Whitmore and F. A. Newcombe.

This invention provides a batch feeder including automatic means for maintaining the desired level of molten glass in the furnace. An electric furnace 11 is shown having electrodes 12 and 13. The furnace may include features shown in Patent No. 2,190,296. The figure discloses a furnace particularly adapted for making lamp bases 22. The lamp bases may be such as shown in Patent No. 2,116,450.

The temperature of the issuing stream of glass is maintained uniform by a radiation pyrometer 21 operating in accordance with Patent No. 2,116,450. The level of the glass in the furnace is regulated by a control apparatus 23 which regulates the operation of the charging mechanism 26. Batch is delivered to the furnace by a screw conveyor 39.

The operator stands on a platform 63 and through electrical connections, controls the operation of a batch box 62 which discharges batch into the bin 41. Mechanism is provided to control the air pressure so that dust is not permitted to escape from the material being delivered. The various mechanisms are electrically connected to insure proper operation.

The patent contains seven claims and 19 references were cited.

Batch Feeder. Fig. 2. Patent No. 2,592,010. Filed originally Jan. 4, 1946. Issued Apr. 8, 1952. This patent expires Sept. 15, 1964. Four sheets of drawings. Assigned to Pilkington Brothers Limited, Liverpool, England, by Horace Cole, Alfred R. Green, Ernest B. LeMare and Robert F. Taylor.

The rear wall of the tank is shown at 4 (lower left) and a movable end wall at 3. This end wall can be adjusted vertically. Heat is supplied from ports 11. A flat platform 12 supports a series of bars 17 which are reciprocated so as to advance the bank of batch 15 on the bottom. Ramps 19 restrain the batch from backward movement. Batch is pushed into the furnace from a bin 20 by a series of reciprocating feed bars 24 and an apron 37. By this arrangement the bank 15, the surface of which is being melted, is moved forward across the full width of the furnace without breaking up the melting surface.

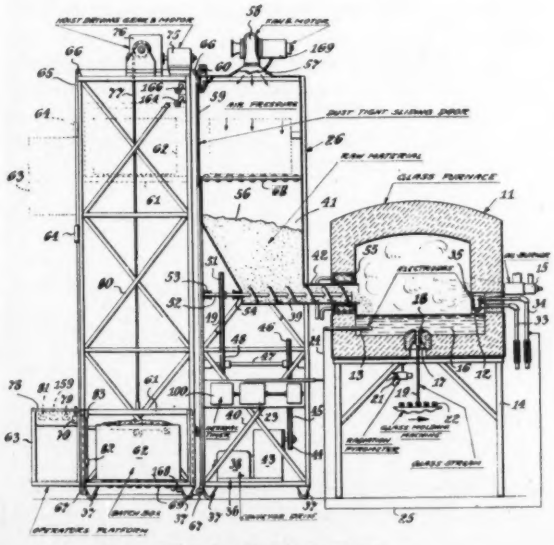


Fig. 1. Batch Feeder.

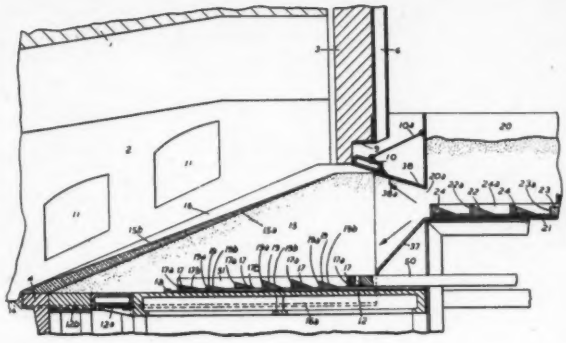


Fig. 2. Batch Feeder.

The patent contains 19 claims and the references cited were 1,400,830, Peebles, Dec. 20, 1921; 1,953,034, Willetts, Mar. 27, 1934; 1,999,761, Howard, Apr. 30, 1935; 2,137,930, Turk, Nov. 22, 1938; 2,272,217, Longenecker, Feb. 10, 1942; 2,284,398, Kutchka, May 26, 1942; 2,284,420, Halbach et al., May 26, 1942; 2,431,799, Gaffney, Dec. 2, 1947; and 598,058, Great Britain, Feb. 10, 1948.

Inclined Melting Furnace. Fig. 3. Patent No. 2,593,197. Filed Sept. 29, 1949. Issued Apr. 15, 1952. One sheet of drawings. Assigned to Owens-Illinois Glass Company by Robert R. Rough.

The furnace includes an inclined portion 12 and a melting chamber 13. Batch is delivered from a feeder 18 to the inclined portion which consists of three sections of gradually decreasing slope. The slope of these sections may run from 45° at the upper end, to 35° and then to 15°. Bubblers 22 supply gas under pressure below the surface of the glass. These are described in Patent No. 2,387,222.

Batch is fed intermittently and is melted by suitable burners 23. The products of combustion pass out of a stack 17. This arrangement is said to rapidly melt glass of better quality than otherwise obtainable.

The patent contains 13 claims and the references cited were 1,610,377, Hitner, Dec. 14, 1926; 1,751,987, Frink, Mar. 25, 1930; 1,863,156, Frink, June 14, 1932; 2,387,222, Wright, Oct. 16, 1945; and 644,561, France, June 11, 1928.

Glass Wool and Fiber

Glass Wool Machine. Fig. 4. Patent No. 2,588,690. Filed Feb. 9, 1949. Issued Mar. 11, 1952. Three sheets of drawings. Assigned to James Hardie & Coy, Pty. Limited, Sydney, New South Wales, Australia.

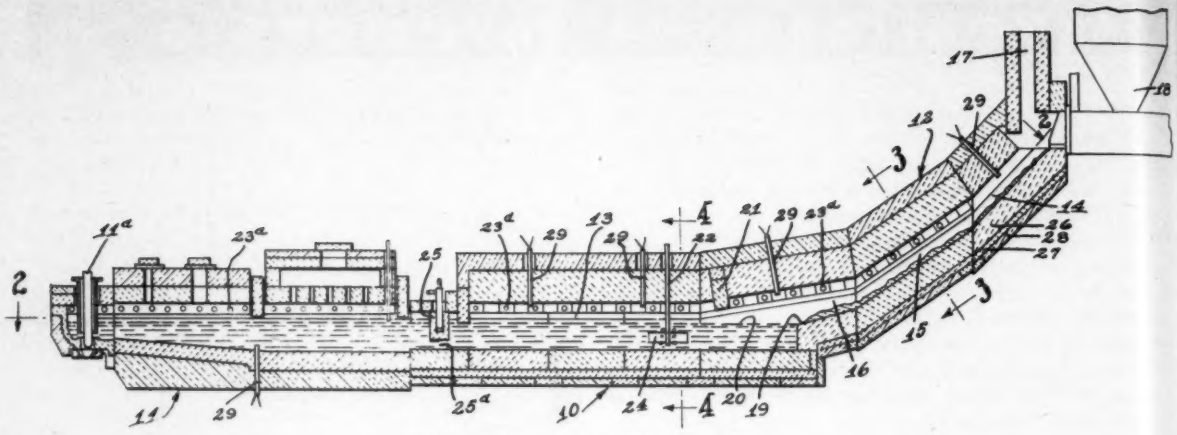


Fig. 3. Inclined Melting Furnace.

This machine draws the molten glass upward by means of sub-atmospheric pressure applied to the upper end of a vertical feed pipe. A chamber 15 is connected to a blast pipe 16 supplying pressure such as steam to a Venturi nozzle 19. A tube 22 dips into the molten glass and is directed toward a top nozzle 21 which discharges into the Venturi nozzle. The port 24, which may be adjusted, breaks up the glass into filaments which may be adjusted by varying the area of the port 24. The fineness of the filaments may be further varied by changes in the temperature of the glass as by the electrode 26. The blast which may be from 30 to 150 pounds per square inch is preferably such as will give supersonic velocity in the Venturi tube.

The patent shows several slight modifications in the structure. There are ten claims in the patent and the references cited were 1,501,449, Hall, July 15, 1924 and 2,235,352, Bates, Mar. 18, 1941.

Sheet and Plate Glass

Corrugated Sheet Glass Machine. Fig. 5. Patent No. 2,590,768. Filed Aug. 21, 1947. Issued Mar. 25, 1952. One sheet of drawings. Roger Guilleminot, Paris, and René Guilleminot, Quievrechain, France, inventors.

This apparatus includes a pair of rolls 1 and 2 by which a flat sheet is formed, an endless chain conveyor 3 and an annealing furnace 4. The links of the chain carry alternately concave mold elements 12 and convex elements 13 arranged so that when the chain is on its horizontal flight a corrugated surface is formed of the desired contour to shape a corrugated sheet from the flat glass.

The soft flat sheet formed by the rolls is shaped by gravity to conform to the surface formed by the elements 12 and 13. Means is provided for driving the chain and cooling the mold elements so that when the corrugated sheet leaves the conveyor, it will hold its shape. The sheet then passes to the annealing furnace 4.

The patent contains one claim and the references cited were 972,433, Blackmore, Oct. 11, 1910; 1,217,614, McCoy, Feb. 27, 1917; 2,350,996, Atkinson et al., June 13, 1944; and 585,154, France, Feb. 23, 1925.

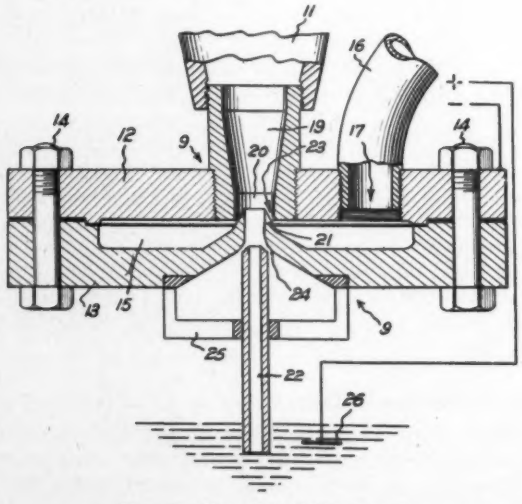


Fig. 4. Glass Wool Machine.

Tube and Cane Machines

Tube and Cane Machine. Fig. 6. Patent No. 2,591,304. Filed April 19, 1949. Issued April 1, 1952. Two sheets of drawings. Inventor Werner Schuller, Banstead, England.

The molten glass flows from the furnace through a channel, controlled by a gate 3, to a rotating drawing pot 4. A protective cylinder 10 projects into the glass and this cylinder is rotated at the same speed as the pot.

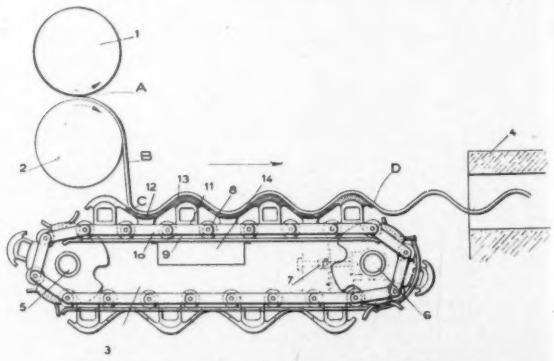


Fig. 5. Corrugated Sheet Glass Machine.

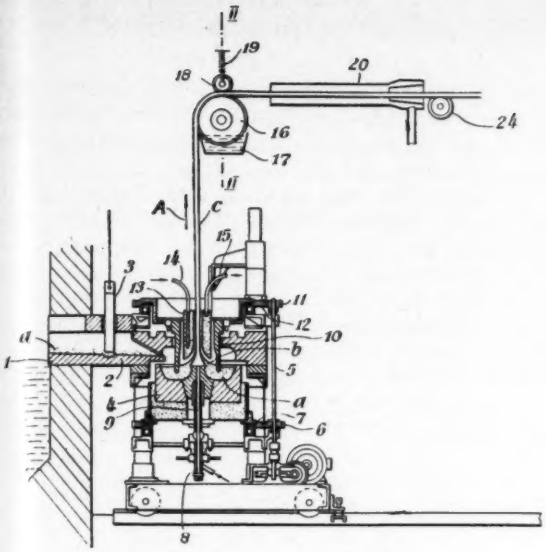


Fig. 6. Tube and Cane Machine.

Compressed air is furnished from the pipes 8 and 9 and water cooling means is provided. From 3 to 6 inches above the pot there is a roller 16 around which the tube (or rod) turns to a horizontal direction and then passes to a cooling device 20 where it is solidified. The tube then goes to a drawing device and a cutting mechanism about as usual. A modification shows a pot from which the tube is drawn downwardly.

The patent contains three claims and ten references were cited by the Patent Office.

Machine for Making Rods of Sapphire, Spinel, etc. Patent No. 2,591,561. Filed April 28, 1943. Issued April 1, 1952. Five sheets of drawings, none reproduced. Assigned to Elgin National Watch Company by R. H. Lester, M. C. Cannon and F. C. Creighton.

This invention is directed to the manufacture of rods of sapphire, ruby or spinel for use in making jewels for watches and other fine instruments. It does not relate to the manufacture of glassware as ordinarily understood.

The patent contains eight claims and 17 references were cited by the Patent Office.

Miscellaneous Processes

Graphite Treatment for Molds. Fig. 7. Patent No. 2,587,722. Filed Nov. 29, 1950. Issued Mar. 4, 1952. One sheet of drawings. Louis D. Garratt and George A. Breene, inventors.

Two tanks are provided, a tank W containing a mixture of soluble oil and water and a tank O containing light mineral oil and graphite, both under air pressure from a supply pipe 9. These tanks are connected to a nozzle 3 directed into the mold 4 and air pressure from the pipe 1 also goes to the nozzle. Valves in the several lines regulate the flow of fluid. This gives a superior cooling of the mold and a better coating of graphite than has been possible before.

The patent contains four claims and the references cited were 1,693,923, Hess, Dec. 4, 1928; 2,246,463, Garratt, June 17, 1941; 2,410,422, Breene et al., Nov. 5, 1946; and Colloidal Graphite and Its Uses in the Glass

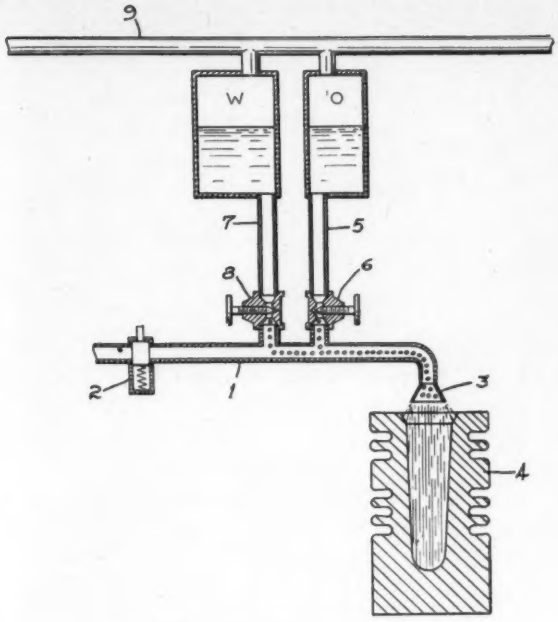


Fig. 7. Graphite Treatment for Molds.

Industry. THE GLASS INDUSTRY, vol. 26, No. 2, March, 1945, pp. 125-127, 151.

Glass Working Method. Fig. 8. Patent No. 2,590,173. Filed Jan. 9, 1948. Issued Mar. 25, 1952. Assigned to Corning Glass Works by Edwin M. Guyer.

The object of this invention is to prevent the occurrence of "flashover" or "wrap-around" effects when glass is heated by the passage of current between electrodes. Previous attempts to this end are found in Patents Nos. 2,306,054 and 2,422,482.

Two electrodes 31 and 32 are water-cooled and arranged on opposite sides of a piece of glassware 33. There is a vacuum connection to the electrodes which can be regulated by a valve 36. Power to the electrodes is derived from a circuit including an adjustable direct current saturable reactor 40, a variable non-saturable alternating current reactor 41 and a transformer 42.

The ware to be severed is rotated by a chuck 34 between the electrodes and by proper adjustment of the reactors 40 and 41 and the vacuum, a rapid melting of the glass is insured.

The patent contains eight claims and 10 references.

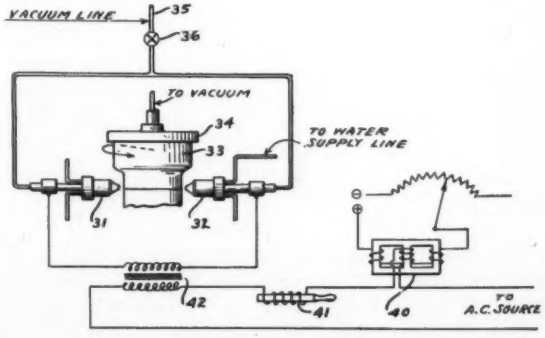


Fig. 8. Glass Working Method.

GENERAL GLASS EQUIPMENT EXHIBITS AT INTERNATIONAL ECONOMIC AND SOCIAL CONFERENCE

At the meeting of the National Conference on International Economic and Social Development, held early in April, General Glass Equipment Company was among the companies to be invited to exhibit.

In the foreground of its display (*see cut*), the company mounted a Ganaglass Batch Charger on a wooden platform. The charger was in operation during the length of the exhibit as a demonstration.

The Conference program sought to broaden the understanding of conditions and problems of the underdeveloped areas of the world and to clarify the stake and responsibility of Americans in the successful operation of programs for economic and social development of these areas.

BARBER-COLMAN PURCHASES ASSETS OF WHEELCO INSTRUMENTS

It has been announced that Barber-Colman Company, Rockford, Illinois, will purchase the principal assets of Wheelco Instruments Company. Wheelco products consist of indicating, recording and controlling industrial instruments, and combustion safeguards.

Present plans are to continue current operations in Chicago until such time as manufacturing facilities can be gradually transferred to Rockford in a manner that will result in the least interruption in shipments. No changes are contemplated in Wheelco's national sales and service organization.

• The Pennsylvania Salt Manufacturing Company has filed a registration statement with the Securities and Exchange Commission relating to a proposed offering to present share owners of rights to subscribe for 155,349 shares of additional common stock.

BOOK REVIEWS

Silicate Analysis, Second Edition

By A. W. Groves

With this book, the author aims to provide a practical and up-to-date laboratory handbook for the analysis of rocks and silicate minerals, and of the silicates—both natural and artificial—used in industry.

In this revised, enlarged edition, the best alternative methods or methods for special conditions have been added and reference has been made to all the more promising work, methods and suggestions published subsequent to the first edition. The range of most useful qualitative tests has been expanded. The section on geochemical data has been considerably expanded, while that on the recalculation of mineral analyses has been entirely rewritten, giving a greater insight into the methods employed by the mineralogist in interpreting and checking chemical analyses.

Published by Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, New York; 336 pages; $5.00.

Glass and W. E. S. Turner

Edited by E. J. Gooding and E. Meigh

This is a volume containing articles by twenty contributors and dedicated to W. E. S. Turner, who has contributed greatly to progress in the glass industry.

This tribute to Dr. Turner, founder of the Society of Glass Technology, consists more or less of a progress report of the glass industry from the day Dr. Turner first entered the field in 1915 to his seventieth brithday in 1951. The subjects covered include The Development of Glass Technology; The Scientific Foundations of Glass Manufacture; The Exploration of the Composition of Glass; The Improvement of the Melting Processes; The Evaluation of Refractories for Glassmaking; The Processes of Production; The Encouragement of Art and Design; The Growth of the British Glass Industry; and International Scientific Cooperation.

Published by the Society of Glass Technology, "Elmfield," Northumberland Road, Sheffield 10, England; 144 pages; quarter bound, stiff cover; Price £.

Refractories Bibliography

1928 - 1947

This compilation of references to the periodical literature and to U. S. and foreign patents on refractories covers the 20-year period of 1928 to 1947. It supplements three bibliographies, published by the American Ceramic Society, which covered magnesite and silica refractories in 1924, and the general subject of refractories in 1927.

Presented by the American Iron and Steel Institute and The American Ceramic Society, the references in the book are arranged by authors whose names are listed alphabetically. The subject matter has been carefully cross-indexed.

Copies are available from The American Ceramic Society, 2525 North High Street, Columbus 2, Ohio; 2109 pages; $15.

• William A. Casler, Assistant Director of Research, has been named Manager of Program Development at Armour Research Foundation of Illinois Institute of Technology. In his new position, Mr. Casler will assist the Foundation's divisions and departments in planning and developing new research programs.

The Use of Electronic Devices in The Glass Industry

The wartime development of electronic devices has provided valuable new tools for both industry and research. In the August 1951 issue of the *Journal of the Society of Glass Technology*, W. J. R. Merren discusses the special properties that make them of value, some examples of their use in the glass industry, and possible future applications in the glass industry.

The chief properties of electronic devices are: (1) all are characterized by the important feature of low inertia. The electron-stream, whether in a photo-cell, valve or cathode-ray tube, follows an applied electrical field almost instantaneously; (2) an electron stream needs very little power to control it. Hence, in general, electronic devices do not modify appreciably the signal controlling them. Further, considerable amplification is possible; (3) the radio-valve can be used as a generator of oscillations.

One of the most interesting problems in the laboratory or factory is the measurement of temperatures below the range of the optical pyrometer. For a temperature of 600°C.(873°K.), the maximum energy of a black body is radiated at about 3.5μ. A receiver sensitive in this region would be very valuable for such measurements. The receiver used by the author is the lead sulphide cell which was developed during the war and is now available commercially. In a practical apparatus, a source at a temperature as low as 100° can be detected. The radiation falling on the cell is interrupted at 800 cycles/second. The alternating voltage when amplified will operate a recorder or an indicator. The optical system consists of a lens which forms an image on a small aperture in front of the cell. This simple arrangement insures that the response is not critically dependent on the distance of the receiver from the source of the radiation.

It has been possible to measure the temperature of glass-forming rolls with this equipment. The apparatus was mounted on a suitable tripod and the roll observed while in operation, and a continuous curve of temperature was obtained. Similar work has also been done in measuring the temperature of a moving casting table and information was obtained about the distribution of temperature.

The same equipment can also be used to study the radiation from various parts of the tank structure. Some work has also been done on the measurement of the temperature of glass after the forming process. This is a matter of some difficulty since the glass is transparent to the radiation. However, by the use of a cell sensitive to 6μ, it should be possible to measure the surface of a hot glass by using wavelengths at which the glass is opaque.

A knowledge of the transmission factor for radiation at different wavelengths would help to answer the following questions: How does heat reach the bottom of a glass melting tank furnace? Is the heat transfer mainly by radiation, by conduction or by convection? Is the mechanism more complicated than has been supposed so far?

The experimental method consists of passing radiation through hot glass where it is reflected from the bottom of a platinum crucible. The modulated radiation and the radiation from the hot glass itself are received by the lead sulphide cell, but only the modulated component is amplified. The modulated radiation is reflected not only from the bottom of the pot, but also from the surface of the glass. The pot is therefore tilted slightly so that the beams are separated and only the beam from the bottom of the pot enters the monochromator. The procedure used was to first transverse the spectrum with the crucible empty. Glass was then added to form a depth of 1cm. and a number of measurements made at temperatures up to 1400°. More glass was added and results obtained for four or more different thicknesses.

Using a glass of average sheet glass composition and having an iron content of 0.16% Fe_2O_3, a series of determinations were made which showed that:

(1) the absorption band due to iron gradually fills up as the temperature is increased; (2) there is some indication that with increasing temperature, the absorption band moves toward the longer wavelengths; (3) in general, with the increasing temperature, the glass becomes more transparent to radiation in the region 9.6-2.5μ. At 1200°, however, there is a definite fall in transmission for the wavelength of 0.6μ; at 1400° this effect is marked; (4) There is an indication of an absorption band at 2.1μ for high temperatures.

There are, of course, other applications of electronic devices in the glass industry. For example, in the laboratory it is possible to study: (1) glass properties at frequencies between the infrared and the long radio waves; (2) electrical properties at high frequencies; (3) optical properties at high temperatures; (4) mechanical properties by electric or electro-acoustic methods (Editor's note: Work along these lines has been conducted by the Preston Laboratories and the description of the apparatus given).

In manufacturing problems, there could be applications to: (1) the study of thermal shock; (2) the analysis of glass-forming operations; (3) the easier measurement of temperature; (4) the control of temperature; (5) the use of servo-mechanisms for the control of processes.

STATISTICAL QUALITY CONTROL COURSE AT UNIVERSITY OF COLORADO

In response to the growing demand, the College of Engineering at the University of Colorado will conduct its third annual training course in Statistical Quality Control during the period June 17 to 27. The course will include the quality control charts, acceptance sampling and other industrial statistical methods.

John F. Wagner, Assistant Professor of Applied Mathematics, will be in charge of the course and there will be instructors, men of national reputation in these fields. Mr. Wagner stated that the course is most useful if men who are acquainted with the over-all production and inspection operations of a particular company are trained in these techniques.

Current Statistical Position of Glass

Employment and payrolls: During February 1952 employment in the glass industry rose to reach a preliminary 138,700 persons. This is only .003 per cent higher than the adjusted employment figure for January of 138,300. During February 1951 employment was 127,300, or 8.9 per cent below February this year.

Payrolls during February were an estimated $40,088,923. This is 2.1 per cent more than the adjusted payroll figure for January of $39,254,150. During February 1951 payrolls were $35,834,101, or 11.8 per cent less than for February this year.

Glass container production for the month of March 1952, based on figures released by the Bureau of Census, rose to the nine-million mark for the first time since October 1951 to reach 9,399,715 gross. This is 7 per cent above the 8,782,780 gross produced during February. Production during March 1951 was 10,986,549 gross, which is 14.4 per cent over March this year. At the close of the first quarter of 1952, production of glass containers has reached a total of 27,123,226 gross. Compared with a total of 30,466,054 gross during the corresponding period in 1951, glass container production is off 10.9 per cent.

Shipments of glass containers also reached the first nine-million figure in about five months. Shipments during March 1952 were 9,214,138 gross. This is 11.3 per cent higher than the 8,277,376 gross shipped during the preceding month. During March 1951 shipments were 10,523,045 gross, or 12.4 per cent more than for March 1952. Total shipments of glass containers at the close of the first three months of 1952 have reached 26,154,347 gross, which is 9.8 per cent off from the 29,014,570 gross shipped during the corresponding period in 1951.

Stocks on hand at the close of March 1952 were 10,215,726 gross. This is 1.2 per cent higher than the 10,092,837 gross on hand at the close of February. Stocks on hand at the end of March 1951 were 8,090,693 gross.

GLASS CONTAINER SHIPMENTS
(All Figures in Gross)

	March 1952
Narrow Neck Containers	
Foods	881,406
Medicinal & Health Supplies	1,207,747
Chemicals, Household & Industrial	654,352
Beverages, Returnable	636,915
Beverages, Non-returnable	18,209
Beer, Returnable	192,218
Beer, Non-returnable	614,181
Liquors	649,215
Wines	329,973
Toiletries & Cosmetics	533,118
Sub-total (Narrow)	5,717,334
Wide Mouth Containers	
Foods	*2,226,039
Dairy Products	227,762
Medicinal & Health Supplies	390,078
Chemicals, Household & Industrial	128,706
Toiletries & Cosmetics	141,209
Packers' Tumblers	173,893
Sub-total (Wide)	3,287,687
Total Domestic	9,005,021
Export Shipments	209,117
TOTAL SHIPMENTS	9,214,138

* This figure includes Home Canning.

GLASS CONTAINER PRODUCTION AND INVENTORY
(All figures in Gross)

		Production March 1952	Stocks March 1952
Foods; Medicinal & Health Supplies; Chemicals, Household & Industrial; Toiletries & Cosmetics	Narrow Neck	3,433,761	3,712,603
	Wide Mouth	*2,889,890	*2,912,265
Dairy Products		211,289	342,675
Beverages, Returnable		759,881	801,592
Beverages, Non-returnable		21,134	32,310
Beer, Returnable		273,326	378,948
Beer, Non-returnable		668,732	739,751
Liquors		659,632	860,899
Wines		297,265	318,549
Packers' Tumblers		184,805	116,134
TOTAL		9,399,715	10,215,726

* This figure includes Home Canning.

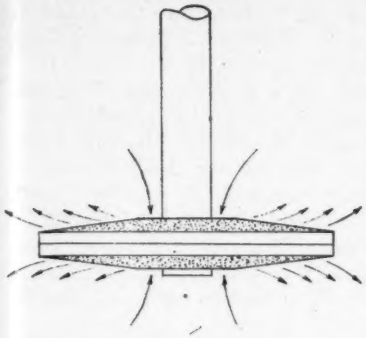
Automatic tumbler figures for January 1952 were incorrectly reported due to a clerical error. Corrected figures are: Production for January, 1,597,056 dozens; Shipments, 1,873,956 dozens; and Stocks, 1,144,632 dozens.

Production of automatic tumblers during February 1952 were 2,019,732 dozens. This is 26.4 per cent higher than the 1,597,056 dozens produced during the preceding month. Production during February 1951 was 1,421,064 dozens. Shipments dropped slightly during February to reach 1,854,648 dozens. This is 1 per cent lower than the 1,873,956 dozens shipped during January. Shipments during February 1951 were 1,496,076 dozens. Stocks on hand at the close of February 1952 were 1,255,332. This is 8.6 per cent higher than the 1,144,632 dozens on hand at the close of January. Stocks at the end of February 1951 were 1,301,544 dozens.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware rose 22 per cent to reach 3,857,152 during the month of February 1952. Sales during January were 3,005,025 dozens; during February 1951, 3,364,357 dozens. Manufacturers' sales at the close of the 12-month period ending February 1952 have reached a total of 38,970,509 dozens. This represents a drop of 4.1 per cent from the 40,641,001 dozens sold during the corresponding period ending February 1951.

• At a national meeting of the American Chemical Society, an emeritus membership was conferred on Dr. Alexander Silverman, Professor of Chemistry at the University of Pittsburgh. Similar certificates were given to other members who have held fifty years of continuous membership.

New Equipment and Supplies



DISPERSER, MIXER AND BATCH FILTER

Equipoise Controls, Inc., P. O. Box 269, Bronxville, New York, has announced a new liquid and gas disperser, mixer and batch filter which features a specially designed porous stainless steel cell unit mounted on a rotary shaft which is driven at high velocity.

The Poro. . Velocell unit is made in two halves. Each half has a saucer shaped porous stainless steel disc welded to a three-spoke wheel design stainless steel mounting plate. The porous discs have a large orifice in the center.

In operation the liquid enters the unit through the large orifices, one above and one below, which are concentric to the rotary shaft. The liquid is thrown out of the cell through the porous metal walls by centrifugal action. The flow of the liquid through the porous metal walls assures maximum shearing action and optimum dispersion against the surrounding liquid. The liquid is filtered simultaneously during the dispersion or mixing cycle.

The design of the mounting plate makes it easy to dismantle the cells and clean each half from the inside. Standard size Poro. . Velocell units are 2⅞″ O.D. Multiple cells can be mounted on the rotary shaft for increased capacity.

NEW THREE-WAY LABORATORY STIRRER

Fisher Scientific Company, 717 Forbes Street, Pittsburgh 19, Pa., has announced the production of a new Fisher Versatile Stirrer which has a very wide application in the laboratory, doing what formerly required at least three different stirrers.

Its three shafts, two of which are geared to the third, or rotor, shaft, provide maximum speeds of 140, 825 and 5000 r.p.m., respectively, and can be regulated to any intermediate r.p.m. from "off" to maximum by the rheostat.

It is simple to use any one of the three shafts, or to change from one to another. A clutch-type clamp makes it easy to swing from one position to another simply by turning a large wing bolt. The stirring rod, which has an eight-inch shaft, is quickly put in position and firmly held by a nickel-plated holder or "chuck." This chuck will accommodate any rod up to 5/16″ diameter, and any special-shaped stirring rod can be quickly inserted in place of the universal type provided with the apparatus.

BIN-LEVEL CONTROL SWITCHES

Stephens-Adamson Mfg. Company, Aurora, Illinois, has announced two additions to its line of "Tellevel" Automatic Bin-Level Control Switches. In addition to the normal-duty Tellevel, heavy-duty and explosion-proof units are now being manufactured to meet special installation conditions. All Tellevels are designed so that a rising or falling level of material in bins deflects a pendant float actuating a micro switch.

Where materials such as stone, coal and ore with lump sizes above ¾″ are being discharged to bins, the heavy-duty Tellevel is recommended. The unit is furnished with a sturdy steel housing protecting the switch mechanism and the standard plastic float ball is replaced by a steel cone. A rubber cup at the base of the housing forms a dust and moisture proof seal to protect the switch mechanism.

The explosion-proof Tellevel is designed for operation in hazardous areas where explosive vapors and dust occur.

CATALOGS RECEIVED

The Exact Weight Scale Company, 944 West Fifth Avenue, Columbus 8, Ohio, has made available a four-page bulletin devoted to "Shadograph Scales."

The illustrated folder discusses six types of scale and lists the various models. Specifications, capacities and sensitivities are given for each. Advantages and suggested uses are also discussed.

Bausch & Lomb Optical Company, Rochester 2, New York, has published a new catalog, "Bausch & Lomb Stereomicroscopes," which is fully illustrated with photographs and sketches of various models and accessories.

The frontispiece of the 20-page brochure cites the many uses of the series' 14 models, whose three-dimensional feature provides a magnified image which is both stereoscopic and unreserved. The catalog points out that industry is rapidly finding more and more application for these optical aids for quality control.

Three types of illuminators are available. They are the Reflector Illuminator with elliptical mirror, the Fluorescent Illuminator which provides cool light of even intensity, and the improved Nicholas Illuminator which furnishes parallel light.

Laclede-Christy Company, Arcade Building, St. Louis 1, Missouri, is distributing a new booklet devoted to its Refractory Bonding Mortars.

Broken down in designations Refractory cements and mortars, Products, Preparation and mixing, and Stocks, the booklet illustrates and discusses numerous products made by the firm. The book opens with a discussion concerning the purpose and selection of refractory mortars, and goes on to illustrate and discuss advantages of applications of the various products.

The Bin-Dictator Company, 13946-36 Kercheval, Detroit 15, Michigan, has announced publication of a new 1952 catalog describing and illustrating the company's products.

The new catalog supplies complete installations data for the various types of units produced; for thin or thick walled bins, for inside or outside location, and for suspended interior installation. Numerous wiring diagrams are included making the book a useful reference manual for installation and maintenance crews. The catalog also describes a companion product, the Bin-Flo Aerator Unit, which is used to introduce low-pressure air into dry, finely ground materials which tend to pack and bridge, and thus restore their fluid characteristics.

Conforming Matrix Corporation, 312 Toledo Factories Building, Toledo 2, Ohio, has prepared a new, full-color brochure which describes methods of reducing decorative spray painting costs.

Subjects treated in the booklet include electro-formed metal masks, foot treadle and air-operated fixtures, fully automatic spray equipment, mask washing equipment and air-operated clamps, fixtures and tools.

Pittsburgh Corning Corporation, 307 Fourth Ave., Pittsburgh 22, Pa., has made available a new 4-page folder about the "Big 3." This folder shows in detail the daylighting function of each of the three new PC 12″ light-directing and light-diffusing functional glass blocks and their counterpart, the 5 PC 8″ functional glass blocks.

Data includes recommended elevations for use of each glass block, description and daylighting performance.

General Electric Company, Schenectady 5, New York, has made available a new eight-page selection guide for a wide range of electric and electronic controls, devices and accessories.

Designated as GEA-5781, the bulletin contains quick-reference selection data, photographs, and listings of additional publications which give complete information on each of the equipments.

STANDARD GLASS SAMPLES AVAILABLE

The Glass Division of the American Ceramic Society standard samples for checking chemical analyses and physical tests are now ready for distribution. These samples represent three glass varieties: soda-lime, borosilicate, and potash-lead. The stocks of glass have been furnished by three glass companies in quantities such that the supply should last for several years.

Samples are in the forms of flat glass and cane cut into four-inch lengths and packed in jars holding about eight ounces each. Storage, packing and distribution are handled by the Department of Glass Technology, College of Ceramics, Alfred, N.Y., where all orders and inquiries are to be addressed. A fee of five dollars is charged for each half-pound sample.

Cooperation of a number of laboratories in making analyses and tests and reporting data is the immediate need. After the collection and comparison of reports by the Standards Committee, accepted values for composition and properties will be assigned to the several glasses and thereafter the data will accompany the samples. In addition to analytical results, the properties of major interest are density, coefficient of thermal expansion, softening point and annealing point. Other properties will be determined as interest develops.

CHEMISTS INSTITUTE AWARDS ANNUAL HONOR SCROLL TO FOSTER D. SNELL

The Fourth Annual Honor Scroll Award of the New York Chapter of the American Institute of Chemists will be presented this year to Dr. Foster Dee Snell, President of Foster D. Snell, Inc., consulting chemists.

A.S.T.M. CHANGES 1953 ANNUAL MEETING DATE

The American Society for Testing Materials has announced that it has changed the date of its Annual Meeting for 1953 from June 22 to 26 to June 29 to July 3. As already announced, the meeting will be held at Chalfonte-Haddon Hall, Atlantic City, N. J.

This change has been made at the request of the Departments of Commerce and State of the Federal Government and specifically of the United States National Commission of the Pan American Railway Congress Association. Arrangements have been made by the Government to hold the Eighth Pan American Railway Congress in Washington and Atlantic City over the period from June 12 to 25, 1953 and, to accommodate so large a group as is expected, the complete hotel facilities of Atlantic City were desired.

WYANDOTTE ASSIGNS SALES REPRESENTATIVE

John L. Craig has been appointed sales representative in Cincinnati, according to an announcement by H. F. Roderick, General Manager of the Michigan Alkali Division of Wyandotte Chemicals Corporation.

Mr. Craig joined the company's market development department in 1949. As a technical field representative, he was responsible for the technological development of the many new organics produced at Wyandotte over the last few years.

Prior to joining Wyandotte, Mr. Craig was associated with Du Pont, working on coated fabrics and finishes at their Newburgh and Philadelphia plants.

Cleaner Glass, Low Maintenance

with **CRYSTALITE Forehearths**

REMMEY CRYSTALITE (mullite-bonded mullite) is produced in all shapes necessary to make up the forehearth assembly. Burner blocks, cover blocks, channels, spouts, tubes, plungers and orifice rings are built to meet specified requirements. These CRYSTALITE parts mean better, more efficient production by offering:

- ★ Accuracy in formation to eliminate time-wasting adjustments.
- ★ High refractoriness and erosion resistance for longer life, fewer replacement shutdowns and cleaner glass.
- ★ Rigid control through each production phase for uniform quality and dimension accuracy.

Get Premium Performance Without Premium Price . . . by using REMMEY CRYSTALITE parts for your forehearth.

Dependable Refractories

REMMEY

RICHARD C. REMMEY SON CO.

Philadelphia 37 • Pennsylvania

Ceramics and Man through the Ages

Greek Calyx-Krater, "Battle of the Greeks and Amazons," about 460-450 B. C. Courtesy of The Metropolitan Museum of Art. For a free chemical analysis of Greek pottery, write to ALCOA.

Master Potters of Ceramicus

Completing the conquest of the Aegean about 1200 B.C., the Greeks proceeded to build the most impressive civilization the world had yet known. In this atmosphere, the potter's art flourished until a sort of ceramic war engaged the potters of rival cities.

About 550, the masters of Ceramicus, the potter's section of Athens from which comes our word *ceramics*, captured the world market with their Black and Red Figure ware. Thereafter, the best ceramic craftsmen migrated to Athens, great schools were formed, and the making of fine pottery became a conceded monopoly of Attica. Primarily interested in line and form rather than color or ornament, the Greeks were the first to use foreshortening, perspective and modeling.

Today's master ceramists rely on ALCOA Alumina for the qualities they want most in their products. They know that ALCOA Alumina reduces deformation and improves whiteness . . . gives added strength . . . improves brilliance and luster . . . reduces chipping . . . resists heat and mechanical shock.

Developed primarily for the aluminum industry and produced in great volume, ALCOA Alumina is available to the ceramic industry at reasonable cost. You should be using it to improve *your* product.

Write to ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION,
613E Gulf Building, Pittsburgh 19, Pa.

Alcoa Chemicals

ALUMINAS and FLUORIDES

ACTIVATED ALUMINAS • CALCINED ALUMINAS • HYDRATED ALUMINAS • TABULAR ALUMINAS • LOW SODA ALUMINAS ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE • GALLIUM

NOW 6:30 P.M.—E.D.S.T.—every Sunday—"SEE IT NOW" with Edward R. Murrow . . . brings the world to your armchair . . . CBS-TV.

C. M. NICHOLSON REJOINS AMERICAN NEPHELINE

American Nepheline Limited, Lakefield, Ontario, has announced that Clifford M. Nicholson has rejoined their organization as Ceramic Engineer.

During the past four years, he has been associated with The Ohio State University Research Foundation. Prior to this, he was chief chemical engineer for Ancor Corporation in connection with production of aluminum oxide from Kaolin. He was formerly with American Nepheline Corporation at Rochester, N. Y., as research engineer, and also with Canadian Bureau of Mines Laboratories at Ottawa, Canada, in this same capacity.

Mr. Nicholson is a graduate of the University of Saskatchewan in ceramic engineering, a member of the Canadian and American Ceramic Societies: The Institute of Ceramic Engineers and Sigma Xi.

CORNING BOARD MEMBERS ALL RE-ELECTED

At the annual meeting of stockholders of Corning Glass Works, all members of the company's Board of Directors were re-elected.

The re-elected directors were: Amory Houghton, Glen W. Cole, William H. Curtiss, William C. Decker, Arthur A. Houghton, Jr., Charles D. LaFollette, George D. Macbeth and Dr. Eugene C. Sullivan, all of Corning Glass Works; and George Murnane, Lazard Freres and Company; Halsey Sayles, Sayles and Evans; Howard C. Dhepperd, President of National City Bank of New York; Lt. Gen. Walter B. Smith, Director of the Central Intelligence Agency in Washington; and Boykin C. Wright, Sherman and Sterling and Wright.

Officers re-elected at the directors' meeting were: Amory Houghton, Chairman of the Board; Glen W. Cole, Vice Chairman of the Board; William C. Decker, President; George D. Macbeth, Vice President and Controller; William H. Curtiss, Vice President and Secretary; Charles D. LaFollette, Vice President and Treasurer; Harry M. Hosier, Dr. Jesse T. Littleton and William C. Taylor, Vice Presidents; William W. Sinclaire, Assistant Secretary; Frederick H. Knight, Assistant Secretary; and C. Henry Kruidenier, Assistant Treasurer. Dr. Eugene C. Sullivan was reelected Honorary Chairman of the Board, and Arthur L. Day was re-elected Honorary Vice President.

L-O-F NAMES DISTRIBUTOR FOR ITS NEW GLASS FIBERS

Direct distribution in California of fiber glass textile products manufactured by the new Fiber Glass Division of Libbey-Owens-Ford Glass Company will be undertaken immediately by Thalco, 765 South Harvard Boulevard. Los Angeles.

• DESIGN
• ERECTION
• OPERATION

of Glass Plants

DOMESTIC AND FOREIGN

Complete Glass Plants and Equipment, Batch Systems, Glass Melting & Sodium-Silicate Furnaces, Batch Feeders, "Schmid" Mechanical Gob Feeders, "Liberty" Pneumatic Gob Feeders, Automatic Handling Equipment, Stackers, Lehrs, Machines, etc. for manufacture of containers, flat glass, pressed ware, and tubing. Furnace Repairs and Rebuilding. Process Engineers.

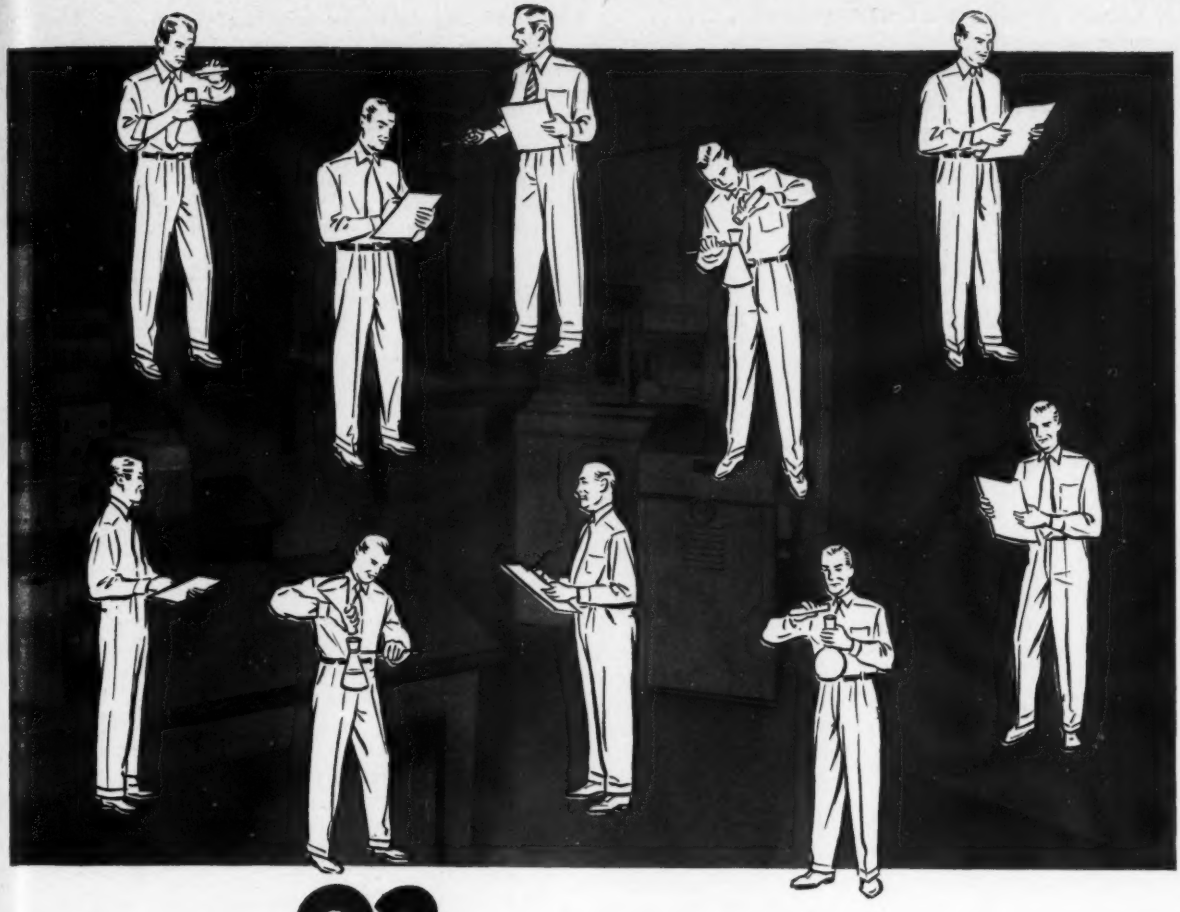
ARTHUR W. SCHMID COMPANY

ENGINEERS AND CONTRACTORS

INVESTMENT BUILDING, PITTSBURGH, PA.

Cable address: **"Schmid" Pittsburgh**
"Glasprint" New York

International Division: **444 Fourth Avenue**
New York 16, N. Y.



WE SPENT 92 HOURS *today . . .*

solving your CERAMIC *and* GLASS COLOR *problems!*

We're Prepared to Help You...

If you, in your own plant, have a problem which needs solving, simply call in the Pemco field engineer . . . or write, wire or phone direct to Pemco. There's no obligation for this Pemco service.

One out of every eight Pemco employes is a laboratory technician or a ceramic engineer. No laboratory in the industry is as well or better equipped than Pemco's research and development laboratory. Here, in an average day, a group of top scientists will probe knowingly into some new development and together spend 18 hours or 56 hours or even 92 hours to prove conclusively, in actual tests, that a new Pemco material will lower your production costs and eliminate some of your production headaches. Constant improvements stem directly from this emphasis on research and development at Pemco, while—at the same time—these same laboratory facilities are keeping production lines everywhere moving with a minimum of trouble because we are working closely with our customers on everyday problems.

"After All, It's the Finish that Counts"

PEMCO CORPORATION

"Always Begin with a Good Finish"

5601 EASTERN AVE., BALTIMORE 24, MARYLAND

"THE WORLD'S FINEST" PORCELAIN ENAMEL FRITS • GLAZE FRITS • PORCELAIN ENAMEL COLORS • GLAZE STAINS • GLASS COLORS AND RELATED CERAMIC MATERIALS

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GLASS CONFERENCE SUMMARIES . . .
(*Continued from page* 252)

charge function of the scale hopper and mixer are electrically interlocked to prevent transfer of a second batch until the preceding batch has cleared. Efficient mixing in cycles of less than two minutes can be attained by one operator weighing five-thousand pound batches, but that rate is seldom necessary.

The batch from the mixing plant bins is transferred to a secondary storage at the furnace by belt conveyor. In one case the conveyor was four-hundred feet long and replaced a container system. The secondary storage capacities range from five to twenty-five tons, depending on furnace consumption. This provides some insurance against mechanical difficulty with the conveyor. The conveyors are operated automatically by capacity indicators in the secondary storage bins and the starting impulse is controlled by a selective timing device. Conveyor operation is quite frequent in order to maintain the surge capacity in the secondary bin at a high level.

In a recently constructed plant, we have initiated the actual practice of another long standing theory. That is the automatic blending of mixed batch ingredients with cullet, each from separate bins. The blending is done by use of one constant weighing device for the batch and one for the cullet. The rate of weighing by each unit ranges from zero to fifteen thousand pounds per hour and is accurate to one-half of one percent at any selected rate. The weighed material blends in a common chute to the conveyor which feeds the secondary storage bin at the furnace. The weighing devices are controlled by the same impulse that starts the conveyor and are interlocked electrically so that each must feed the quantity pre-selected or neither will function. There are several standard units of this general type on the market and weight recording is provided for .

The purpose is multifold and economic. First, if wet cullet is the result of an operational condition in the production process, with this method the difficulties that are involved in its handling are minimized as the only contact with the batch ingredients is in the final conveying operation or perhaps right at the furnace. Second, the maintenance cost resulting from wear caused by putting the cullet through the processing equipment is eliminated. Third and most important, when cullet ratios are high, valuable storage space is saved. Cullet, when weighed and mixed with the batch ingredients, is actually stored in two forms: first as raw cullet, and second as part of the mixed batch. For example, if the cullet ratio is fifty per cent, and one-hundred tons of mixed batch storage is required, fifty tons of that amount is cullet. The raw cullet storage is still necessary in any case, but if the cullet is blended directly from the raw storage the cost of fifty tons of storage capacity is saved or made available for other materials.

The raw cullet may be stored in a bin adjacent to the furnace and the blending done at that point, if it is more practical structurally. Actually, with an operation of this type, there is no necessity for the cullet to enter the mixing plant at any time.

I will deal briefly with the question of dust proofing. We have used sand seals, liquid seals, sponge and foam rubber seals, canvas curtains in series to act as baffles, and canvas dust boots. Many of the conveyors are totally enclosed, and the longer units have dust proofed loading and discharge sections. In every place, where possible, we have vented the displaced air from the receiving unit back to the source of the material with good success. Insofar as we know, there are no dust collecting systems in any batch plant we have designed, and they have complied with the health department requirements in a number of states.

Electrical controls have been developed to an extent that leaves little to the mixing plant operator, except to know what material is in a certain car when it is unloaded. In our most recent plant, the distributing unit over the bins has to be repositioned each time a railroad car is moved from the unloading position and another one moved on. This is a final step to insure against contamination, and is accomplished by use of an electric eye, which controls the starting system for the equipment.

EARLY GLASSMAKING . . .
(*Continued from page* 256)

venture in ornamental staining and enameling was practiced at 45 Fremont from the late Seventies. He was soon located at 39½ Fremont, however, under the style of the California Art Glass Bending and Cutting Works, where he operated a successful business until Wm. Schroeder succeeded him in 1890 under the name of Hopper & Schroeder. After a season Schroeder dropped the name of Hopper, but he continued to carry the name of the California Art Glass Bending and Cutting Works onward into the 20th Century. The firm received a Gold Medal at the Midwinter Fair at San Francisco in 1894, an award at the Paris Exposition in 1900, and took the honors at Portland, Oregon, in 1905.

These are but a few of the names that were successfully rooted in the historical background of glass in early California. Frederick C. Kaulfuss, an engraver on glass, J. B. Bowen, H. A. Hammerschmidt, Robert Boyle, Edward O'Neil, Joseph Mino, A. J. Burgeon, Henry Baker, and Thomas C. Butterworth—all of these men were connected with the stained glass industry in its earlier years.

Mirror Manufacture

Cameron, Whittier & Co. were the first to practice the art of silvering glass in San Francisco. The business was established at the southwest corner of Front and Pine Streets, in 1863, and began with one workman and one silvering table. Two years later the company was turning out work valued at approximately $18,000 a year, and gave steady work to four skilled employees. Mirrors as large as 110 x 114 inches were produced, the plate glass coming mostly from France, with a little imported from Germany. Quicksilver was locally available, but all of the other materials had to be imported, with the tin foil coming principally from Great Britain. The firm had become Whittier, Fuller & Co. in 1867, and the new proprietorship began by handling and installing window as well as plate glass. They remained in this business at the original location for many years, expanding and successfully competing with all of their competitors as their activity grew on the coast.

The San Francisco Embossed Glass Works

This firm had for its proprietor the congenial W. H.

(*Continued on page* 270)

TWO YEARS OF SERVICE

and STILL going strong!

AFTER 111 WEEKS

FIRST PORT

SECOND PORT

THIRD PORT

About 100 weeks was the longest the ports of this flint container furnace used to last. That was before they were made of MONOFRAX H fused cast refractories — our special superstructure refractory.

These unretouched close-ups of the MONOFRAX H ports graphically show their excellent condition after 111 weeks service. These are the right hand ports — the left hand ones are in equally good shape. Glass was pulled from this tank at the rate of approximately 45-50 tons daily.

The No. 1 ports, of course, take the brunt of the attack. If it had not been for the need to replace the silica crown, the No. 1 ports would not have been disturbed. As you see, even after 111 weeks they could have given considerably more service. Ports 2 and 3 on each side are perfectly sound and will continue in service. The operator expects they are good for *at least another two years.*

MONOFRAX H material is installed in all 6 ports of this flint container tank. It is used for the port arches, jambs, skews, breast wall blocks and intermediate arches. Type H is also used in the ports of many other tanks operated by this company.

Make it a point to check on *all* our MONOFRAX refractories — types H, MH and K. Test them against all types of glass. In the superstructure or in the tank proper, these 3 high alumina refractories can appreciably reduce your refractory costs per ton of glass. For further data, address Dept. L-52, Refractories Div., The Carborundum Co., Perth Amboy, N. J.

Use fused cast refractories by

CARBORUNDUM

Trade Mark

for long campaigns...quality glass

"Carborundum" and "Monofrax" are registered trademarks which indicate manufacture by The Carborundum Company.

EARLY GLASSMAKING . . .

(*Continued from page* 268)

Warren, and was located successively at 997 Market, 832 Mission, and 2 Sutter. A description of its production from the mid-Eighties may serve to present an interesting picture of what was perhaps going on in similar institutions in other parts of the country at that time.

Production included hanging lamps, illuminated in a variety of colors and cut designs, for hotels, saloons and private residences. Looking-glasses were hand-painted or were embossed in colors. Glass advertising signs were a specialty and, as such, were ornamented in gold and silver. Names of streets were embossed on red and blue glass for street lamps. The company even controlled spaces in the windows of the cable-cars which were "to let" for purposes of advertising in this novel manner.

In the line of artistic glass, numerous designs were offered, embossed on ground or clear surfaces. Sold by the "square" (per square foot), prices ranged from $1.00 for a simple subject, to as much as $6 per "square" for the more intricate executions. Door-panels, such as a "Knight in Armor", "Stag at Bay", "Group of Cupids" and others too numerous to mention, together with transom lights as companion pieces, were executed or were made to order as the client might desire. Bay-window glass, bordered with cupids and flowers or other designs, could be had on short notice. Table tops of embossed and beveled plate mirror type glass were executed with Tennyson's "Elaine" and similar subjects having a classical background. Even a three-leafed fire screen, embossed in red, white and blue glass, might be purchased at the trifling price of a mere $50.

Church glass, created by artists of European heritage, and representing such well-known subjects as "Christ Turning Water Into Wine," et al., were offered at square foot prices as follows: on 26-oz ruby glass, from $2 to $6; on blue glass, $2.75 to $7; and on yellow glass, from $1.50 to $5 per sq. ft., depending upon the amount of work entailed in production. The same on 21-oz glass at a lesser fee.

A large variety of designs for 4- and 6-inch borders, likewise, corners, on 26-oz glass, were available. 75 cents per running foot was charged for these on ruby glass; 90 cents on blue. On 21-oz glass, the price was 65 and 75 cents, respectively. Designs were also produced, executed from original ideas submitted by a client, and these could be enlarged or reduced in size as the case might demand.

In judging the foregoing it should be realized that this exemplifies the manner in which ordinary stained glass was delivered to the consumer in the heyday of its saturated production. This, as we know, is the direct conflict to the manner in which the master craftsman sets himself to work in the production of a masterpiece such as he may be quite capable of producing, and for which it is only reasonable that he command a compensatory return. Every age, however, has its peculiarities and a percentage of its artisans who always strive for public appeal and who always set themselves to the task of developing the mechanics which can best supply what that age thinks it most sincerely desires.

PHOTOGRAPHIC EXHIBIT IN MEMORY OF E. L. HETTINGER

The Edwin L. Hettinger Memorial Exhibition of Photography, an annual show in memory of the late Edwin L. Hettinger, amateur photographer and member of the Reading School Board, Reading, Pa., was featured at the Reading Public Museum and Art Gallery March 23 through April 20.

Mr. Hettinger, who died September 2, 1951, was, for more than 30 years, Director of Optical Research at Willson Products, Inc.

ANNUAL REPORTS OF GLASS COMPANIES AND SUPPLIERS

In its 1951 annual report, Glass Fibers, Inc., reported net sales totaling $3,596,339 as compared to $3,255,100 in 1950. Earnings for 1951 amounted to $352,293 as compared to $466,349 for the previous year.

Laclede-Christy Company reported net earnings in the amount of $915,501 during 1951. Net sales during this period were $15,202,141. This company is now presenting its financial statement on a calendar year basis, it formerly having ended with November. Therefore, its 1951 annual report covers a period of 13 months.

The annual report of American Window Glass Company reported net earnings for 1951 of $710,092, equal to $2.25 per share, compared to $628,136, equal to $1.88 per share, in 1950. Net sales for the year amounted to $18,427,908, compared to $17,024,072 in the preceding year.

Anchor Hocking Glass Corporation reported net sales of $91,746,115 during 1951 compared to $83,671,060 in 1950. Income before taxes was $10,646,847 in 1951 compared to $10,964,996 in 1950.

Reporting the largest volume of business in the company's history for twelve months, Thatcher Glass Manufacturing Company's annual report showed sales of $23,235,486 for the twelve-month period ending March, 1952, compared to $20,617,704 for the corresponding twelve months ending March, 1951. Earnings before taxes were $2,300,404, compared with $2,067,728 in the preceding year. Net income was $1,019,038, equal to $1.53 per share. Net income for the preceding year was $1,101,228, or $1.67 per share.

Owens-Illinois Glass Company reported net sales and other operating revenues of $298,171,607 at the close of the 12-month period ending March, 1952. This compares with $307,638,413 for the corresponding period ending March, 1951. Net earnings were $15,606,810, or $5.11 per share, as compared with $26,202,363, or $8.57 per share, for the two years.

CHAS. TAYLOR NAMES PLANT MANAGER

Everett G. Couch, Jr., has been appointed Plant Manager of the Taylor, Kentucky Works of The Chas. Taylor Sons Company, a subsidiary of National Lead Company.

Mr. Couch received his Bachelors Degree in Ceramic Engineering from North Carolina State College in 1931 and his Masters Degree in Ceramic Engineering from the University of Toronto in 1933. After graduation, Mr. Couch was employed by the Corhart Refractories Company and the Anchor Hocking Glass Corporation. He has been with Chas. Taylor since 1943.

GLASS PLANT MAINTENANCE . . .
(*Continued from page* 245)

Training

An apprentice program was set up in 1947 by the company and local union, in order to provide a uniform method of training which would assure apprentices of proper training in the trade which they may choose, and also assure the company of competent workmen at the conclusion of the training period.

An apprentice committee consisting of an equal number of management and union members, together with an apprentice supervisor, is responsible for carrying out the training program.

Applicants for apprentice training are given tests to determine their qualifications, and must be approved by the committee before they are eligible for training. Those completing the training course are given certificates as journeymen in their respective trades.

These 8,000-hour apprentice courses are now provided for machinists, electricians and pipe-fitters. The course is registered with and approved by the Pennsylvania Apprentice Council.

Conclusion

Maintenance operations are usually classed as auxiliary or non-production functions, but with the large amount of electrical and mechanical equipment required in the modern production methods, maintenance is a necessity and, although good maintenance may not be in a position to show a profit on its own, poor maintenance will definitely reflect in lower production and higher costs.

This we have realized and every effort is made to set up and carry on a well-balanced and efficient maintenance program in line with the production requirements.

CORNING OPENS NEW SALES OFFICE

Corning Glass Works has announced the opening of a new sales district office in Washington, D. C., and the appointment of Charles L. Day as Manager.

Mr. Day will act in a liaison capacity between Corning research, engineering and manufacturing groups and the various agencies and departments of the U. S. Government.

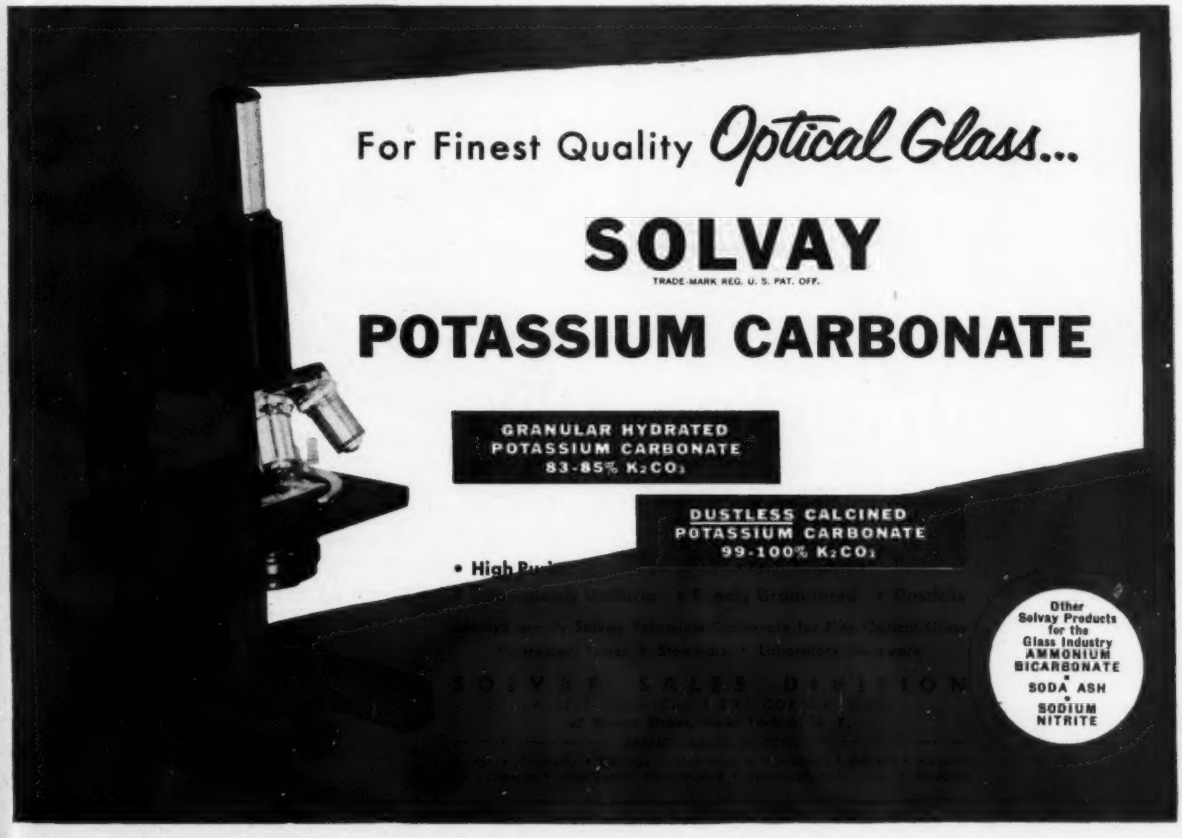
The manager of the new district office joined Corning in 1936 as a sales engineer in the Technical Products Division, and became associated with Owens-Corning Fiberglas Corporation at the time of its foundation in 1938. In 1943 he accepted a sales position with the Union Asbestos and Rubber Company, returning to Corning in 1947 as Eastern Sales District Manager for the Technical Products Division.

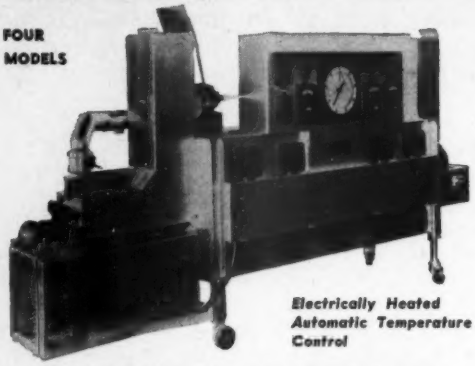
HAZEL-ATLAS APPOINTMENTS

J. H. McNash, Bruce H. Seabright and Walter H. McClure were reeletced Directors of the Hazel-Atlas Glass Company at the recent Annual Meeting of stockholders.

It was also announced by J. S. Algeo, Vice President and General Sales Manager, that E. F. Westwood has been appointed head of the company's Pittsburgh District Sales Office.

Mr. Westwod has been associated with the firm since 1918, most recently as Pittsburgh sales representative.





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This annealer was designed and built for the Electronic industry. It has now been in operation for the past year and a half.

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They're your assurance of uninterrupted trouble-free production at a time when stoppages cannot be tolerated.

For additional information write or phone our nearest sales office.

EAST: Wickwire Spencer Steel Division, Clinton, Mass.

WEST: The Colorado Fuel & Iron Corporation, Denver, Colorado

PACIFIC COAST: The California Wire Cloth Corporation, Oakland, California

WISSCO BELTS

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

CF&I

L-O-F- FIBER GLASS OPERATION . . .
(*Continued from page* 244)

Naturally, the physical and chemical properties of glass are also present in its fibrous form, i.e., moisture-proof and rot-proof, physical and chemical stability, non-combustibility, and high tensile strength. However, by creating fibrous glass, many additional properties are added. These are, in general, flexibility; increased tensile strength; presentation of added surface area for filters or for application of protective or other chemicals which enhance possible end uses; and for the Super Fine glass, entrapment of tiny air particles, resulting in more perfect thermal insulation; and presentation to sound waves of an acoustically efficient material.

Primarily, the needs of the national defense rearmament program are first to be satisfied. Secondarily, it is the function of fibrous glass to fill urgent civilian requirements and to relieve pressure on many restricted and critical materials.

Fiber glass is replacing many natural and manufactured fibers in its continually expanding usage in textiles, insulation, and in reinforcement of plastics to supersede metal. Although it gained great impetus during World War II, more than 500 applications to civilian uses have occurred in the postwar period.

Hence, Libbey-Owens-Ford, by entry into the field of fiber glass manufacture, has taken the responsibility not only for supplying an unfilled demand, but also for creating newer uses for fiber glass and supplying greater service to customers.

Plaskon Division of L-O-F recently announced that it will market a plastic molding material which combines

increase storage capacity from DAYS...to WEEKS with a modern

MARIETTA STORAGE SYSTEM

A Marietta concrete storage system is the efficient, economical way to increase your "per-day" storage capacity. Marietta tanks permit you to buy and store bulk materials in large quantity to take advantage of favorable prices, meet unexpected shortages.

Tanks are constructed of Air-Cell or solid concrete staves, can be erected in any size, any arrangement, in a matter of weeks, to give you permanent, fully protected storage for coal, coke, sand, gravel, dry chemicals . . . any bulk material that requires safe, low-cost storage.

Marietta engineers will plan, design and erect a Marietta storage system to meet your present and future plans. Tanks can be equipped with loading and unloading facilities to speed your materials handling.

Write for full details and illustrated literature.

the **MARIETTA** concrete corporation
MARIETTA, OHIO • BALTIMORE, MD. • CHARLOTTE, N. C.

fiber glass for plastic reinforcement mixed with Plaskon's new high-production alkyd resin. This product is now being evaluated for military uses but it is also available for use in certain civilian products where it may prove superior to some scarce metals.

Many other important developments are planned.

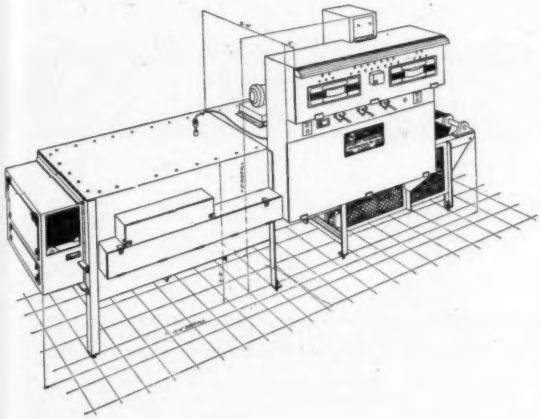
LYNCH ELECTS DIRECTOR

The Board of Directors of Lynch Corporation has announced the election of Ernest M. Oswalt as Director of that corporation. Mr. Oswalt has been intimately associated with Lynch since it started the manufacture of glass forming machines.

Mr. Oswalt was founder of the Campana Corporation which was established in 1926. In constructing its manufacturing plant at Batavia, Illinois, the firm was one of the first extensive users of glass blocks made on Lynch machines. This plant, built in 1937, was constructed without windows, depending on glass blocks for the dissemination of daylight.

In addition to being Chairman of the Board of Directors of Campana Corporation, Mr. Oswalt is President of the Du Page Lumber Company and an Honorary Member of the Chicago Historical Society.

• William C. Schneider has been appointed sales representative by Selas Corporation of America and his territory will include central and western New York State. Mr. Schneider's headquarters will be at 315 Brooklawn Drive, Rochester 18, N. Y.



• Above illustration shows a special electric oven for the annealing of light ware as required for the electronic field.

Our knowledge of glass factory problems is your assurance of first quality glass melting and manufacturing equipment, as well as top service and performance.

We shall be pleased to consult with you concerning your manufacturing problems.

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